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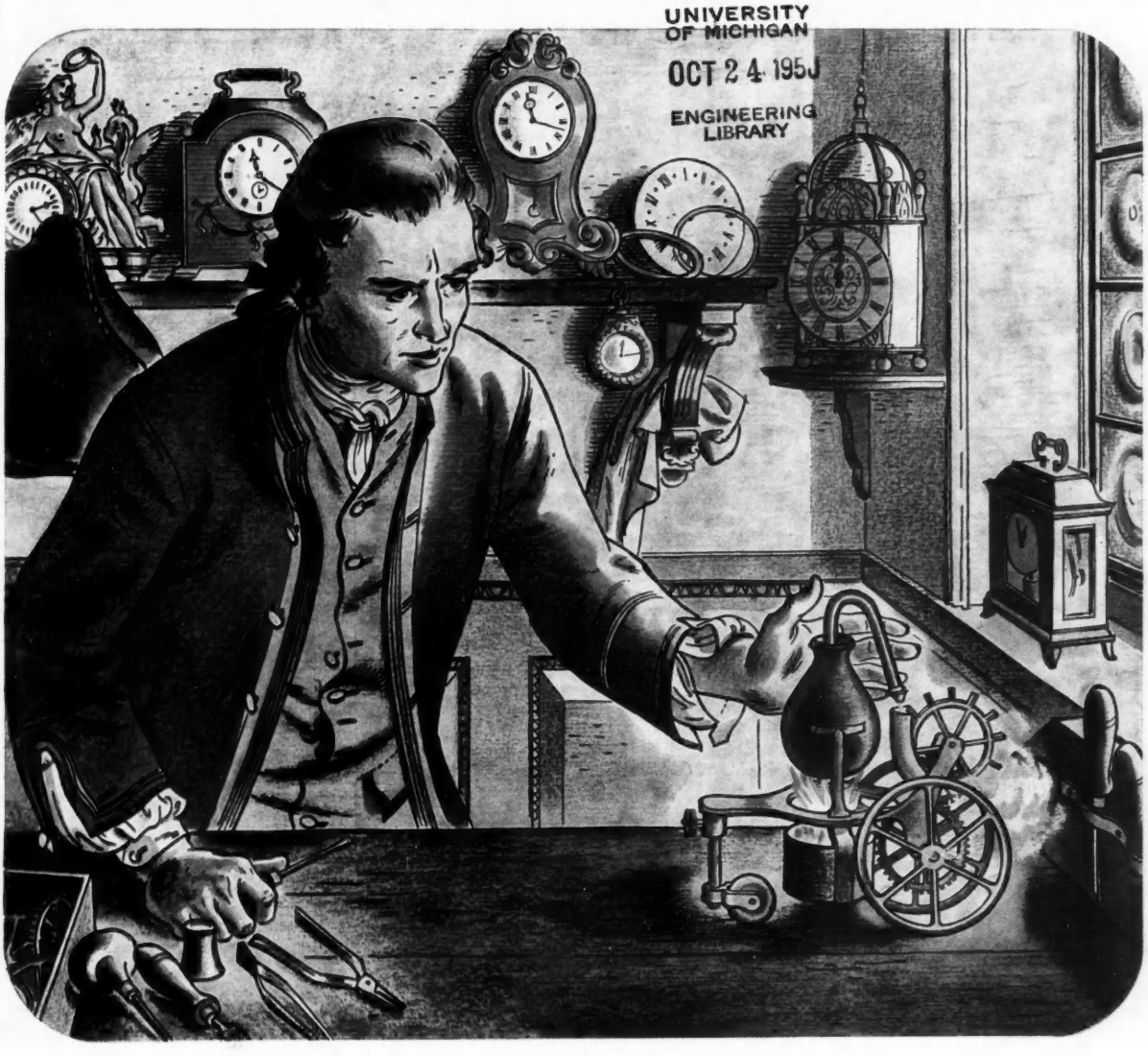
The Engineer

VOL. CXC—No. 4941 | 28, ESSEX ST., STRAND, LONDON, W.C.2 | OCTOBER 6, 1950

Established 1856 | Price 1s. 6d. By Inland Post 1s. 9d. | Registered as a Newspaper



In the days before Napoleon...

The principle of turbine propulsion was known on the Continent before the rise of Napoleon. But it's a far cry from this little toy to the monster steam turbines of today.

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The lack of suitable constructional materials made the development of this ingenious mechanism impossible. Today there are metals which give new ideas a better chance. There is Monel, for instance, which has strength at high temperatures, resistance to corrosion and to the cutting action of steam.

MODEL TURBINE CAR: HOW IT WORKED

A spirit lamp burning beneath the copper vessel caused a jet of steam to strike the vanes of the rotor at the rear of the car. This was connected by reduction-gear to a pinion keyed to the axle. The toy continued to run as long as any water remained in the improvised boiler. The maker is unknown, but the model itself is dated 1775 *and is believed still to exist at Karlsruhe.*

36/CR/4a

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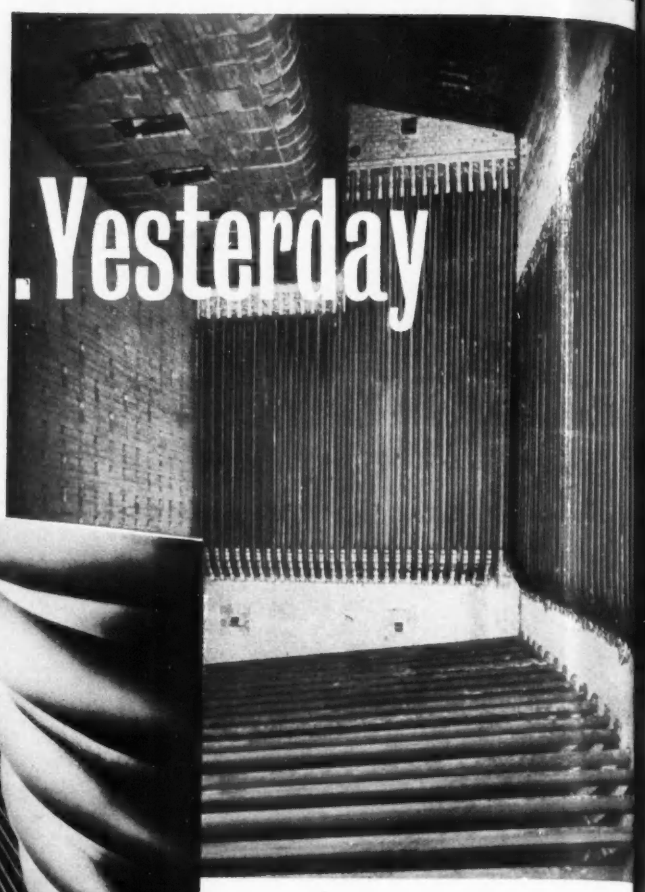

This fully-cooled combustion chamber at Stuart Street Power Station, Manchester, is one of the latest developments in steam generation by pulverised fuel firing. 25 years ago the 'latest' was the refractory type shown on the right and installed at Barking. In the progress towards more and more steam with less and less fuel, ICL, backed by more than 50 years' experience in the field of combustion have played a leading part.

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A Seven-Day Journal

London Tram Conversion Scheme

LAST Saturday night, September 30th/October 1st, the first stage in the scheme for converting the tram routes in South London to bus operation came into effect. Five tram routes and a short trolleybus route were replaced by five new bus routes. The tram routes withdrawn from service were numbers, 12, 26, 28, 31 and 34, and they have been replaced by the following new bus routes :—44, Mitcham Fair Green to London Bridge Station ; 168, Wandsworth High Street to Farringdon Street ; 169, Clapham Junction to Victoria ; 170, Wandsworth High Street to Hackney, and 45, South Kensington Station to Farringdon Street. As a result of this conversion to bus operation eighty-seven trams have been scrapped and six transferred ; twenty-one trolleybuses have been transferred, and 123 buses introduced into service. As has already been announced, a number of tram depots are being reconstructed as bus garages, and in this first stage of the scheme the reconstructed Wandsworth tram depot has come into full use as a garage. Clapham tram depot has also been put into partial use as a garage pending completion of the reconstruction work at this establishment. As a result of the conversion work some 30 miles of single tram track have become redundant as well as the Battersea substation which was used in connection with the tram services.

The Training of Engineers

IN the course of his Presidential Address before the Institution of Engineers and Shipbuilders in Scotland on Tuesday last, Professor Gilbert Cook spoke of the dilemma which faced those who were concerned with the education and training of engineers. He asked how could a curriculum be designed which would provide the opportunity for acquiring the advanced knowledge now demanded in all branches of engineering practice and at the same time perform the still more important function of training men to think for themselves and to take the wide views so essential for success in leadership. Few, he said, would subscribe to the doctrine that specialisation was necessarily the enemy of culture, but there was a danger that the demand for the expert might conflict with the satisfaction of the need for men with balanced minds and powers of judgment without which sound leadership would fail. Professor Cook went on to deal with the need for increased facilities for higher technological training and spoke of a suggestion which appeared first to have been made in the pamphlet " The Problem Facing British Universities," prepared by a Committee appointed by Nuffield College. This suggestion was that in order to relieve the growing pressure on accommodation the study and teaching of engineering subjects might be taken out of the universities and concentrated in special institutions. He contended that such a step in withdrawing from the engineers the cultural training would be disastrous in its consequences to the profession. How, said Professor Cook, could such a proposal be reconciled with the demand that men destined for leadership in the engineering profession should receive a wider training and should be encouraged to develop a broader outlook on human affairs ?

National Physical Laboratory Report

THE annual report giving details of the work carried out during 1949 at the National Physical Laboratory has just been issued. The section of the report dealing with the Engineering Division shows that a major work of this department has been on the fatigue and creep of metals. One of these investigations was on the fatigue strength, under repeated tension stresses, of sheet metal test pieces each containing a drilled hole. It is pointed out that a reduction in fatigue strength occurred with increase in width of a specimen, both for undrilled specimens and those with a central hole of diameter in proportion to specimen width. For specimens of given width the adverse effect of the hole was found to decrease as the hole diameter was reduced, which is in conflict with results of mathematical theory. A new standard deadweight hardness testing machine was completed by the department. In the Metallurgy Division iron of 99·96 per cent purity was in regular production. It is stated in the report that the ingots produced weighed 25 lb each, but the process could be easily operated on a larger scale. Testing of the iron over a temperature range from 200 deg. to −196 deg. Cent. has begun. Pure iron, says the report, will behave in a perfectly ductile manner at −14 deg. Cent. and in a brittle manner at −16 deg., and in tensile tests is ductile at −73 deg. Cent., but brittle at −186 deg. Cent. The Ship Division worked on research into the extent and influence of laminar flow on ship models, a subject important in the selection of the best ship form for given circumstances. The performances of ships and of models are being compared ; trials have been made on ships and on models under conditions exactly similar to those of the ship trials.

Institute of Marine Engineers

IN his Presidential Address to the Institute of Marine Engineers on September 28th, Sir A. Murray Stephen, M.C., B.A., said that he wished to emphasise, as did Lord Rotherwick last year, the importance of reliability in marine engines, because unlike land installations the breakdown of a ship inevitably incurred heavy financial loss and unwanted publicity. The necessity of absolute reliability had meant that developments in marine engineering had been made cautiously and the efficiency of modern machinery was such that each advance was more difficult. He made the point that the cost of increasing efficiency was now an important factor because first cost, depreciation and other charges might be greater than the savings effected by a smaller fuel bill and increased deadweight. Sir Murray went on to discuss the gradual disappearance of coal as a fuel, the increasing competition of the diesel engine, and future trends in the field of gas turbines and atomic energy. Fashions in funnels were commented upon and the advantages of the short, wide funnel and the tall, thin funnel compared, the balance being in favour of the old design if too much attention was not paid to the æsthetic side. Shipowners, he averred, were slaves to fashion, but that was not altogether a bad thing, because it meant that more ships were built. Another fashion was the streamlining of ships' deckhouses, and this was deprecated in that the reduction in air resistance was practically nil, while such erections were costly to build and uneconomical concerning space. The advance of welding was briefly mentioned, such as the substitution of fabrications for castings and the approach of the all-welded ship, in which the importance of accuracy in relation to cost was underlined. Continuing, Sir Murray stated that comparisons between costs of pre-war and post-war vessels were misleading, because, among other things, improvements in auxiliaries, increased speed and roomier crew accommodation added considerably to the price. Finally, Sir Murray discussed research and touched upon the work of PAMETRADA on turbines, and of the British Shipbuilding Research Association on ships and machinery, making special reference to the " Lucy Ashton " resistance trials.

Packaging

THE Anglo-American Council on Productivity has published this week the report of a specialist team which visited the U.S.A. at the end of last year to study packaging practice in the factories of that country. The team, which was representative of several industries in this country, was led by Mr. G. M. Ashwell, of Imperial Chemical Industries Ltd. In the introduction to the report, the statement is made that packaging in this country costs not less than £300,000,000 a year, and the importance of packaging processes and methods is emphasised. The successful package, the team points out, is the one which can be filled rapidly, effectively and cheaply with the least use of floor space. A particularly interesting chapter in the report is that devoted to packages and packaging materials. Although during its tour the team saw no packaging materials which were unknown in the United Kingdom, the existence of all types of packaging material in the U.S.A. is associated with a widespread availability quite unknown in this country. Here, the report says, we are often obliged to overcome the lack of the right materials, and poor quality, by ingenuity and invention. The hope is expressed that the authorities responsible for raw materials, their variety, quality and availability will take careful note of the team's findings. In a survey of lay-out, machinery and methods, which is included in the report, it is suggested that much of the very high speed machinery employed in the U.S.A. to meet the demands of mass selling in an enormous home market would have little application in Britain. But, it is observed, machines are also available which combine high operating speed with a much greater degree of versatility than is usually found in those produced in this country. The team feels that there is a real need in many industries in the United Kingdom for machinery of this type, and thinks that, where it is not available from British manufacturers, the expenditure of dollars to obtain it from the U.S.A. would be amply justified.

Productivity Team's Report on Electric Motor Control Gear

THE report has now been published of the productivity team of the motor control gear and small airbreak switchgear branches of the electrical manufacturing industry. This report particularly recommends the standardisation and simplification of types with special reference to the extended use of direct started squirrel-cage motors. Once this standardisation and simplification has been obtained each manufacturer should then specialise in one portion only of the range of gear still required. Other recommendations include the provision of power-operated tools, elimination of unnecessary handling and the provision of mechanical assistance to reduce physical effort in production. It is stated that the outstanding lesson learned from the tour was that circumstances had enabled the American control gear industry to effect simplification and standardisation to a much greater degree than has been possible in this country. There were few restrictions on the part of electricity supply undertakings with regard to permissible switch-on currents of motors, and attention was paid by manufacturers to the production of squirrel-cage motors with low switch-on currents. The fact was also recognised that when direct started squirrel-cage motors were used, circuit protecting devices had to be able to withstand high starting current, and that to make this practicable the usual cable requirements must be relaxed. The team does not suggest that it is practicable to eliminate all the alternative types of starters from the range of British manufacture, nor does it think that it would be economical for all makers to embark on mass production on American lines. As regards airbreak switchgear, it was concluded that the designs and methods of production in America did not appear to be superior to those in this country. The report points out that though full application of its recommendations would have a far-reaching effect on productivity, there is not in this country the same scope for mass production of control gear as in the United States.

The Selection of Junior Draughtsmen

By FRANK HOLLIDAY, B.Sc.*

The Apt and the Inapt

TWO boys apply for an engineering apprenticeship. The first, A, an intellectually, very ordinary, and moreover lackadaisical boy, with little discernible ambition, scores extremely highly on certain aptitude tests—particularly those prognostic of draughtsmanship—but his score on an intelligence test is only average. The second boy, B, with an excellent school record, is full of ambition to enter engineering and become a draughtsman; his scores on the aptitude tests are poor, his score on the intelligence test very good. They are both accepted. A does excellently at engineering drawing and is extremely successful in the drawing-office, some years later. B shows a marked inaptitude for the subject, scoring 0 per cent in his first examination, although, of sixty-two comparable such boys over the five-year period 1941–5, 90·3 per cent were successful and 29 per cent of them obtained a "credit" mark. He proceeded to the next year's course of study (Final Ordinary National Certificate), his mark in engineering drawing and design being 27 per cent. Repeating this subject the following year, his mark was 45 per cent—a bare pass mark.

A man is working half-time in the stress office; the other half of his time he is endeavouring to initiate an apprentice training scheme. Time and time again it is brought home to him that, whereas the pure mathematics part of his stress office work is "just his cup of tea," he is like a fish out of water trying to read drawings, attempting mentally to manipulate them, as is so often necessary in detail stressing. He realises with what difficulty he visualises in the solid the detail and the configuration of forces acting on it, from the plane views of the drawings. One hour of this really exhausts him; an eight-hour day of pure mathematics entails no such exhaustion. In his brief, previous drawing-office experience he could not fail to observe the same thing: how utterly fagged he became in his efforts to translate solids into three plane views and, in reading drawings, to translate back again into the solid, views in the plane. And yet again, in teaching mathematics, he had observed the (to him, later, significant) fact that the only part of mathematics that gave him any trouble was the "solid" part—solid geometry, trigonometrical problems in three dimensions, &c. The author knows something of this case, for it was himself.

The Explanation?

Why is A destined to be so successful a draughtsman and B a failure? What is the explanation of the author's above-mentioned experiences? The answer can only be found in the nature of the abilities called for. The late Dr. C. S. Myers writes:[1]

"It is widely recognised now that in very varying degrees a single 'general' factor of intelligence is involved in all forms of purposeful activity; and that there are also a considerable number of 'group' factors, each of which is common to a particular group of activities and of 'special' factors, each of which is peculiar to a single, simple form of activity. There is undoubtedly a group factor underlying 'mechanical' and certain other abilities, which concern the readiness to perceive the sizes, shapes and spatial relations of objects. With this 'spatial' factor certain tests that have been devised prove by mathematical analysis to be highly saturated. In the daily work of the engineer this factor is involved in his translation of two-dimensional diagrams into three-dimensional objects, and *vice versa* (as in the reading and making of drawings), in the patternmaker's and moulder's ability to imagine the 'inverse' of a pattern or object, &c. There is reason to believe that it is also involved in the engineer's 'machine sense,' as shown in his ability to realise how a machine works—how its parts fit together, how, if one of the parts is set in motion, another will move, &c."

What is the bearing of this on draughtsmanship? Simply this, that the ability to draw and to read drawings and, generally, to be able fluently and easily to think "in the solid"—which is at the very heart of draughtsmanship—is distinguishable from and relatively independent of general intelligence. Further, this ability may be assessed with a fairly high degree of accuracy by reputable tests. This explains the futility of attempting to select boys for apprenticeship or as drawing-office trainees by an interview and a study of, for example, school reports and school certificates results; for whilst by such means a rough idea of a boy's intelligence level may be ascertained, it is not possible to make even a rough guess at this all-important aptitude. (An aptitude, by the way, may be described as a potential ability, i.e., it may, through training and/or experience, become an ability which will show itself in skill of one sort or another. When they applied for apprenticeship, neither of the two boys mentioned at the beginning of this article had done any engineering drawing before. They could not, therefore, be said to have any ability for it. But the aptitude tests indicated quite clearly that on subsequently being taught the subject the first boy would develop considerable ability for it, whereas the second would not.)

Entry to the Drawing-office

My observations suggest that even where serious efforts are made to select the most suitable applicants, aptitude and intelligence tests can and do give vital information which is obtainable in no other way. Two cases will serve to illustrate my point:—

(1) A junior of elementary school education was moved to the design drawing-office in 1939, after serving about two years in the plan room, and a further two years in the alterations department. It was confidently predicted that he would become, in due course, a good senior design draughtsman. Several years later this forecast is admitted to have been completely false. The then youth, now a man of about thirty years of age, is still an excellent draughtsman in the sense that he can draw, but he has never been able to acquire an Ordinary (to say nothing of a Higher) National Certificate, and he lacks the brains for anything other than routine draughtsmanship in a purely subordinate capacity. He can make a very competent drawing when he is told what to draw; design draughtsmanship is quite beyond his scope. His aptitude test scores were extremely high; as high, in fact, as the top 10 per cent of fairly stringently selected engineer apprentices, but his intelligence test score was inferior to those of all but the bottom 10 per cent of such apprentices. It was far lower than the minimum required of the potential design draughtsman.

(2) Another youth had been to a good junior technical school with which close contact had been maintained for many years. His passing-out examination result was exceptionally good; he obtained a first-class diploma with six distinctions (out of a total of nine subjects). He was an unusually competent model maker, and had won several prizes at exhibitions on a national level. He had over five years' experience to his credit in different departments, had worked as a draughtsman in one department, and was moved, in about early 1942, to the drawing-office. To his good experience he added the valuable qualities of extreme keenness and ambition. How did he fare? By the summer of 1945 he had proved thoroughly disappointing. The author, who had followed him up for a number of years, was then quite convinced of the genuineness of the considered opinion of the head of the office: "He is very keen and a hard worker, but—he is hopeless. He just hasn't got it in him." His intelligence test score was well within the bottom 10 per cent of public and grammar school boys tested, and within the bottom 30 per cent of several hundreds of trade apprentices tested. Both these men took the tests in the autumn of 1938.

These cases are given, not only for their intrinsic interest, but because they illustrate the utter lack of control of such methods of promotion. Even where such methods can hardly be described as "hit or miss," the outcome is altogether unpredictable. They take no cognisance of the fundamental facts that the intelligence required of the potential design draughtsman is of an altogether different order from that required of the routine, detail draughtsman, and that this is a quality of his mental make-up distinct and distinguishable from his ability to "think in the solid"—a quality that all draughtsmen need. Moreover, they appear not to recognise that it has been established beyond any doubt whatever, by long and scientifically controlled investigations, that a good and suitably administered intelligence test will predict a candidate's intellectual "ceiling" extraordinarily accurately, and that suitable aptitude tests will similarly predict those aptitudes necessary for successful draughtsmanship.

In the author's own company, before there was any selection of apprentices worth calling by the name, the manner of filling a junior drawing-office vacancy was this: the chief draughtsman would at once consult with those of his draughtsmen who taught in the company's evening classes, with a view to choosing with the minimum of delay a suitable junior from the works. There was then, thank heavens, no risk of the vacancy being filled by one of those apprentices! The position two or three years later was radically different. The chief draughtsman then referred all junior applicants to my department—a tribute that speaks for itself.

There is no doubt that the method of choosing junior draughtsmen by examination from those apprentices having fairly high minimum academic qualifications (e.g. a good Ordinary National Certificate) is effective. But the author's investigations show that even in this case the giving of aptitude and intelligence tests is desirable. And in any case the lack of control inherent in such methods of selection is not eliminated

* Consultant on Industrial Training. Formerly: Apprentice Supervisor and Head of the Technical School, Vickers-Armstrongs, Ltd., Weybridge; Member, Surrey Education Committee's Mathematics and Mechanical Engineering Examinations Boards; Member of the Society of British Aircraft Constructors' Sub-Committee on Training.

by any means; it is simply pushed one stage further back—to the apprentices from whom the candidates for the drawing-office examination are to become available.

There is a close connection between ability for skilled practical engineering work and ability for engineering drawing and, to the extent that there is, it is important that an individual's ability for skilled work in the shops should be carefully assessed, and given due weight when his suitability for entry to the drawing-office is under consideration.

So common—and justified—did the author find the drawing-office complaint that it is usual to find that many of the junior draughtsmen who are excellent at drawing board work are quite unable to cope with even the elementary mathematics of draughtsmanship that, over a number of years, he collected numerous examples from the works, drawing-offices and other technical departments, which he used in teaching engineering mathematics to apprentices and junior draughtsmen. They were subsequently published in book form.[2]

A Comprehensive Policy Necessary

It cannot be too strongly emphasised that all firms should have a detailed, comprehensive policy concerning recruitment and concerning selection and training at all levels. Selection at one level, e.g., of juniors for the drawing-office comes back, partly, at any rate, to the selection of apprentices, and this in its turn depends partly upon the number and quality of the boys applying for apprenticeships and partly upon the number and quality of the boys applying to enter, and actually entering, the works at a pre-apprenticeship age, a proportion of whom will, or should, later become apprentices. The thing is a series of connected links. The effectiveness of one link depends directly on the effectiveness of all the preceding links. The *ad hoc* methods so often in evidence are not only extremely wasteful, but, when once a sound, comprehensive policy has been laid down and when the company's requirements in the way of juniors are looked at as a whole, they are the longest, the most trouble and the least satisfactory in every way.

An official letter of 1945, concerning the more advanced training desirable to enable junior draughtsmen to become seniors and section leaders, stated that "all junior draughtsmen entering the industry must be of such calibre that they are at least capable of becoming good seniors." But this imperative is completely futile unless those concerned know how to select such juniors—and the overwhelming majority still do not.

The recruitment, initiation, allocation and supervision of boys has been dealt with elsewhere.[3,4,5] Work of this nature is of the very highest importance in every way, direct and indirect, over the whole field of employment in this country. There is no other way in which wastage — mental, physical, moral and financial—could be so effectively cut down with such desirable results.

Trade Tests and the Direct Approach

Draughtsmen other than the company's own juniors are usually engaged on the basis of an interview and on their works and previous drawing-office experience. No attempt has been made in this country, as far as my knowledge goes, to refine this rather rough way of choosing draughtsmen by, among other things, the application of standardised tests of achievement (which usually come under the heading of "trade tests"[3]); nor has any body of draughtsmen been given aptitude tests, though the formation of norms of performance[4] for draughtsmen of different levels would be desirable for many reasons, and a useful adjunct to such work as the author's.

In America, standardised tests of attainment—which must not be confused with aptitude and intelligence tests—are more widely used; for example, the Lockheed Aircraft Corporation[3] uses such tests of draughtsmanship, so does the Western Electric Company,[3] to cite but two instances. Dr. D. W. Cook, who is in charge of psychological testing, test research and test development and standardisation at the latter company, in which tests have been used for twenty years, gives some interesting results[6] showing the relation between test scores and subsequent "job performance" of fifty-eight junior draughtsmen. Of those who obtained above-average scores, 73 per cent were subsequently rated as above-average draughtsmen, and only 13 per cent as below-average draughtsmen. Only 4 per cent of those who obtained below-average test scores were subsequently rated as above-average draughtsmen, whereas 66 per cent were below average.

Selecting Apprentices—a Few Results

Reference to the author's various papers[7] will furnish the background and some of the results of his investigations into selecting apprentices, which began in 1938.

How can the relation between apprentices' test scores and their occupational proficiency be represented, and what is its extent? Fig. 1 shows a reasonable and fair way of

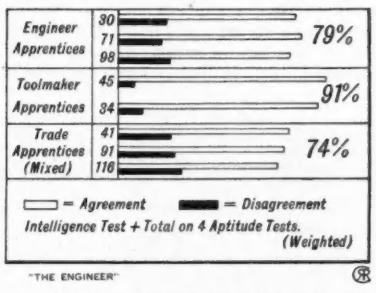


FIG. 1—TEST SCORES AND SUBSEQUENT PROFICIENCY

answering this question (though not, of course, the only way). The numbers down the left-hand side are those comprising the groups of apprentices. Those in any one group were assessed for their occupational proficiency into three sub-groups: above average, average and below average. The average mark obtained some substantial time previously on some psychological tests (the score on the intelligence test being "weighted" with that on the total of four short aptitude tests) was determined for the whole group. Apprentices were then divided into four sub-groups:—

(*a*) Those above average on the tests and assessed as above average;

(*b*) Those above average on the tests and assessed as below average;

(*c*) Those below average on the tests and assessed as above average;

(*d*) Those below average on the tests and assessed as below average.

The numbers of apprentices in each of these sub-groups were expressed as percentages of the total number in the four sub-groups. The sum of the percentages for sub-groups (*a*) and (*d*) represented "agreement," and for sub-groups (*b*) and (*c*) "disagreement." The high degree of correspondence between test scores and subsequent proficiency speaks for itself. The percentage figures on the right are average figures of "agreement" for each of the three sets of apprentices, the engineer apprentices, the toolmaker apprentices and the "mixed" trade apprentices. A systematic study of all apprentices in sub-group (*b*) shows that they largely comprise apprentices on whom adverse character traits of occupational significance have been recorded. Many of those in sub-group (*c*) are similarly those on whom particularly favourable traits have been recorded. It will be appreciated that when such cases are allowed for the percentage figures of "agreement" are even larger. They are, in fact, of the order of 95 per cent.

It is important that Fig. 2 should be clearly understood, since it is from such a basis that Figs. 3, 4 and 5 are obtained.

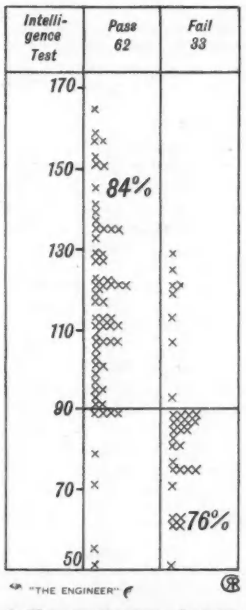


FIG. 2—MATHEMATICAL ABILITY AND INTELLIGENCE TEST SCORE

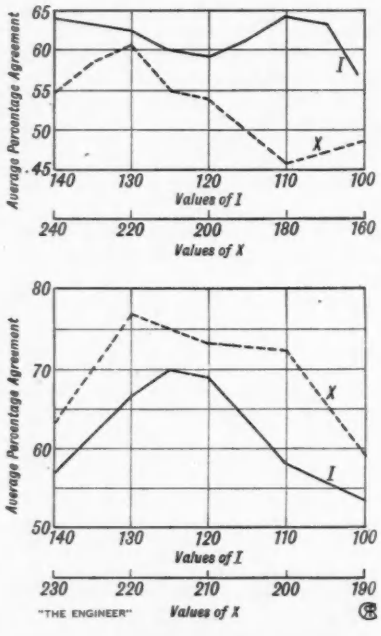
Each cross represents an apprentice's intelligence test score in N.I.I.P. Group Test 33. It is placed in the left-hand or the right-hand column according as, on his first attempt at *S*1 mathematics (First-Year National Certificate *S*1 Course) he passes or fails. A line has been drawn across at score 90. Of those who pass in the mathematics examination, 84 per cent had previously scored 90 or over on the intelligence test. Of those who fail in the mathematics examination, 76 per cent had previously scored less than 90 on the intelligence test. Now suppose† the line represents an admission score to the *S*1 course, boys scoring 90 and over being admitted, those scoring under 90 being rejected. Clearly, the object would be to admit only potential passes and to reject only potential failures. No method of selection is perfect and here some boys who would subsequently pass are rejected, whereas some boys who would subsequently fail are admitted. On an average, though, the admission score would be fair in 80 per cent of cases (the mean of 84 per cent and 76 per cent).

An average figure of "agreement" (such as the 80 per cent figure here) can clearly be obtained from each of several "admission" scores on any test—not only on the intelligence test. Fig. 3 shows such average percentage figures of "agreement" plotted to a base of "admission" score. The examination concerned is now the *S*3, Final Ordinary National Certificate examination in mathe-

† In practice, tests are not used as "go" or "no-go" gauges; all the relevant information is considered in every case.

matics taken by ninety-five apprentices for the first time. The full-line corresponds to the intelligence test *I*, as the "admission" test, which all candidates had taken some years previously; the dotted line corresponds to the total "admission" score *X* on four short aptitude tests. It will be observed that, over the whole range of "admission" scores, *I* gives a better measure of "agreement" than *X*, i.e., the intelligence test is more effective than the aptitude tests as an aid to admitting the greatest proportion of those who will subsequently pass the *S*3 mathematics examination, and as an aid to rejecting the greatest proportion of those who will subsequently fail.

Fig. 4 is a similar graph for the same group



FIGS. 3 & 4—ADMISSION SCORE ANALYSIS

of apprentices (less one who sat for the mathematics, but not for the drawing), the examination in question now being the *S*3, Final Ordinary National Certificate examination in engineering drawing and design. This time the *X* graph is higher than the *I* one; i.e., over the whole range of "admission" scores, the aptitude tests are more successful than the intelligence test in enabling subsequent successes at the *S*3 engineering drawing and design examination to be picked out, and subsequent failures to be rejected. The conclusion to be drawn from this, and from other similar, as well as different analyses, is that it is not possible to predict an individual's engineering drawing ability from the level of his general intelligence.

That each of the four aptitude tests, taken separately, is more effective than the intelligence test as a means of "admission" where subsequent success at engineering drawing is looked for, is shown in Fig. 5, similarly obtained. *S.P.*, *V.M.*, *F.C.* and *F.R.* denote the aptitude tests and *I* the intelligence test.

Examples showing the astonishing improvement in examination results from 1939 onwards, as the percentage of apprentices selected by the aid of psychological tests increased from zero to 100 per cent, have been given in others of the author's papers.

In early 1940 he acted in his selection of apprentices on his opinion that there would be a crying need in his company for good-calibre technical staff, draughtsmen included, and that that need could be met, to any appreciable extent, by no other source than apprentices. Less than three years later he

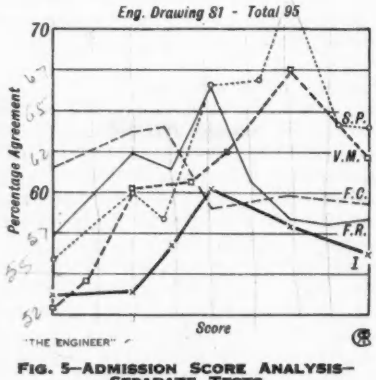


FIG. 5—ADMISSION SCORE ANALYSIS—SEPARATE TESTS

was able to forward really good-calibre apprentices, with an academic minimum of an Ordinary National Certificate, to the various technical departments of his firm to an extent comparable with that achieved by other training schemes three times as large or larger.

PREDICTING SUCCESS AT ENGINEERING DRAWING

The close agreement between, on the one hand, the careful assessment made of the engineering drawing ability of the members of a preliminary (*J*2, i.e., pre-*S*1) class of twenty-three apprentices, by their instructor (himself a section leader of considerable experience) at the conclusion of the academic session, and, on the other hand, their aptitude test scores is indicated by the typical example shown in Table I. The instructor

TABLE I

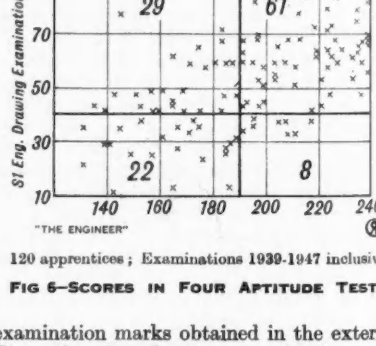
D	*S*	P.D.
E	*E*	—
E	*E*	—
E	*G*	1
G	*E*	1
G	*A*	1
G	*F*	2
G	*G*	—
A	*A*	—
A	*A*	—
A	*A*	—
A	*A*	—
A	*A*	—
A	*A*	—
A	*A*	—
A	*G*	1
A	*G*	1
A	*A*	—
A	*P*	2
F	*A*	1
F	*F*	—
F	*A*	1
F	*F*	—
P	*F*	1

placed a group of twenty-three boys in an estimated order of merit for ability at engineering drawing and also divided them into five grades: excellent (*E*), good (*G*), average (*A*), fair (*F*) and poor (*P*). The column under *D* therefore represents an order of merit for ability at engineering drawing, the first boy marked *E* being top, the second boy marked *E* being second, and so on. The boys were now placed in an order of merit on the total score, *S*, of several‡ aptitude tests, and were sub-divided so as to give numerical correspondence with the instructor's gradings, i.e., the first three boys were marked *E*, the next four *G*, the next eleven *A*, &c. Each boy's test grade is now placed opposite his drawing grade. Point differences are now inserted under the heading *P.D.* (A point difference over the five-point scale between, e.g., *E* and *G* or between *A* and *F*, is a point difference of one; that between, e.g., *E* and *A* or between *G* and *F* is a point difference of two, &c.). The close correspondence between the two orders of merit is evident. In only two cases is there a noticeable difference between the gradings based on the instructor's estimate of ability for engineering drawing and those based on the aptitude tests.

It may be remarked here that, wherever comparisons have been made between test scores and a criterion such as engineering drawing ability, &c., all cases of "disagreement" were diligently studied at the time the comparison was made, and have been studied in the light of subsequent events. It is a remarkable and, from both the theoretical and practical points of view an important fact, that test indications give, in almost every single case, a better agreement with "ultimate" success than with earlier assessments. The earlier differences between e.g., an instructor's gradings and gradings based on the tests practically disappear.

So great is the "resolving power" of the tests—to borrow an analogy from Optics—that even where apprentices are selected fairly stringently to achieve certain ends, those with the higher scores still tend to do better than those with lower scores. For example, an analysis was carried out to find the distribution in the examination grades, fail (below 40 per cent), pass (40–64 per cent), credit (65–84 per cent) and distinction (85 per cent and over), of those of the 143 apprentices who had sat for the *S*3 Final Ordinary National Certificate examination in engineering drawing and design, and who had, some years previously, obtained a total aptitude test score of (*a*) 210 or higher, or (*b*) less than 210. Among the ninety-one apprentices in sub-group (*a*), i.e., who had scored 210 or higher, there were 11 per cent of failures, but there were 19 per cent of failures in sub-group (*b*). Further, there were 4½ per cent of distinction and also 33 per cent of credits among those in (*a*), as against 0 per cent of distinctions and only 13½ per cent of credits in (*b*).

A scatter graph such as that shown in Fig. 6 is perhaps the most direct way of showing the connection between test scores and subsequent examination marks in, e.g., engineering drawing. It represents the



120 apprentices; Examinations 1939-1947 inclusive

FIG 6—SCORES IN FOUR APTITUDE TESTS

examination marks obtained in the external *S*1 engineering drawing examination, over the nine-year period from 1939 to 1947 inclusive, of each of the 120 apprentices who sat for the examination for the first time, plotted to a base of their total scores on four short aptitude tests. The horizontal full line is drawn to correspond with the pass mark of 40 per cent in the drawing examination, and the upright full line to correspond with an "admission" score of 190. The first thing that strikes the eye is the very marked

‡ This analysis was made before it was decided to use four aptitude tests only.

tendency of apprentices who had previously obtained good scores on the tests to obtain high marks in the drawing examination, and *vice versa*. Actually, sixty-one apprentices who "passed" on the tests subsequently passed in drawing, whereas only eight failed.§

It is impossible to keep the standard of any examination exactly the same from year to year and, further, a candidate's performance is determined, to a certain extent at least, by whether the particular questions set suit him or otherwise. Those apprentices whose mark on the drawing examination lies between 30 per cent and 50 per cent may fairly be described as "border-line" cases. They lie between the two horizontal lines 30 and 50. If the reader will cut a strip of paper so as to cover up these cases, the tendency observed above is seen to be set more clearly still into relief. The figures in the four rectangles are now $\begin{Bmatrix} 12 & 52 \\ 13 & 0 \end{Bmatrix}$. There is "agreement" in 52+13 or 65 cases, and "disagreement" in 12+0 cases; i.e., "agreement" in 85 per cent of cases.

Action Indicated

No vital training officer, no chief draughtsman, no general manager, no managing director even, can read the findings of this article and those of others referred to, without realising that if, in his firm, the manner of recruiting and selection is poor, it can be vastly improved—without realising, in fact, that even if it is good, it can be made better still. Tremendous improvements may be effected in a short while. Not so long ago, a cautious management tended to look askance at psychological tests. But now such tests, and the procedures, generally advocated by occupational psychologists have come to stay; there is no doubt of that. And so the live manager will wish to try out these improved procedures, which, in the hands of a balanced and trained executive, result in so greatly an increased productivity, and, at the same time, in so greatly an increased contentment on the part of all concerned. Not even shortage of available recruits is a sufficient excuse for further apathy, for, curiously enough, nothing attracts more and better recruits so much as extremely careful, even stringent, selection procedures which suggest the genuine seriousness with which a company regards its trainees and its staff.

Acknowledgments

The editor and author acknowledge, with thanks, permission to reproduce Fig. 1, first published in *Far and Wide*, September, 1946, and permission to reprint Fig. 2, first published in the April, 1946, number of the *Journal* of the Royal Aeronautical Society.

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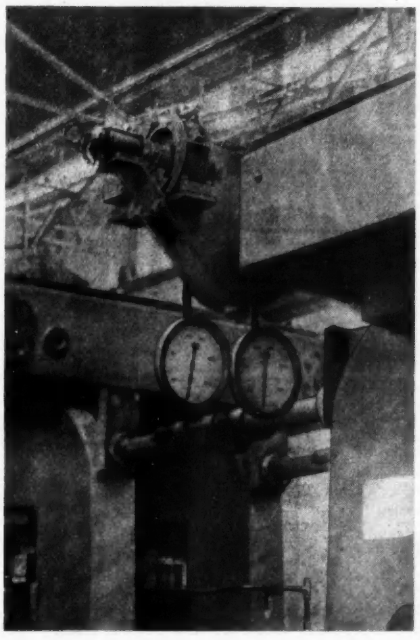
§ The numbers shown on the figure apply to the rectangles divided off by the full lines.

Strip Rolling Mill

THERE was recently delivered to Sweden a four-stand tandem strip rolling mill, designed for the high-speed cold rolling of high carbon and stainless steel strip. It was

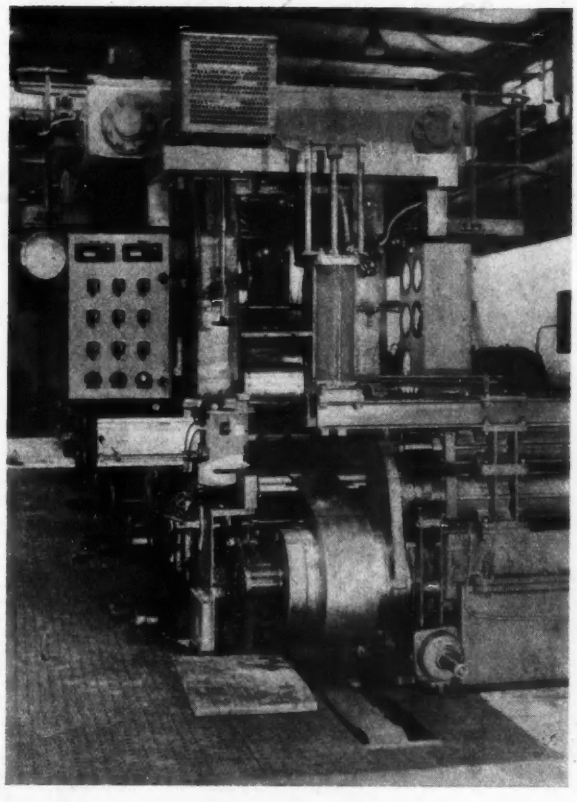


STRUTS AND PRESSURE INDICATORS

built by Sir James Farmer Norton and Co., Ltd., of Salford, Manchester. The plant is designed to handle coils of 10in wide strip up to 1 ton in weight and to roll them down to thicknesses from 0·140 to 0·105in. The four-high stands have work rolls 7in diameter and 20in diameter and backing rolls with working faces of 14in. Each stand is equipped with individual d.c. motor drive. A similar drive is used for the coiler, which follows the fourth stand. The mill was built to the order of the Uddeholm Company, of Sweden, and in its design it had to be borne in mind that a minimum number of operators would be available. For this reason all controls had to be centralised and the mill made as automatic as possible in operation. As special steels had to be rolled, a medium rolling speed was adopted. Generally speaking the programme up to the present has been that of rolling mild steel up to the maximum speed of 600ft per minute, while stainless steels of the 18/8 quality are rolled at a maximum speed of about 320ft per minute.

An interesting method has been developed for indicating the tension of the strip between the stands. In the arrangement which has been adopted the fourth stand only is securely tied down to the mill bed in the conventional manner. The three preceding stands are each carried on hardened steel rockers located under the centre of each housing, so that a few degrees of rocking motion is available in the direction of rolling. When the strip is under tension during rolling the tendency for the housings to close together is resisted by struts carried between the stands. Each of these struts incorporates a pressure element, which indicates the tension in the strip on dials. One of our illustrations shows the struts between the housings and the pressure dials. The six dials, one for each housing, can also be seen on the general view of the mill. All six dials are clearly visible to the chief operator situated at the coiling end of the mill.

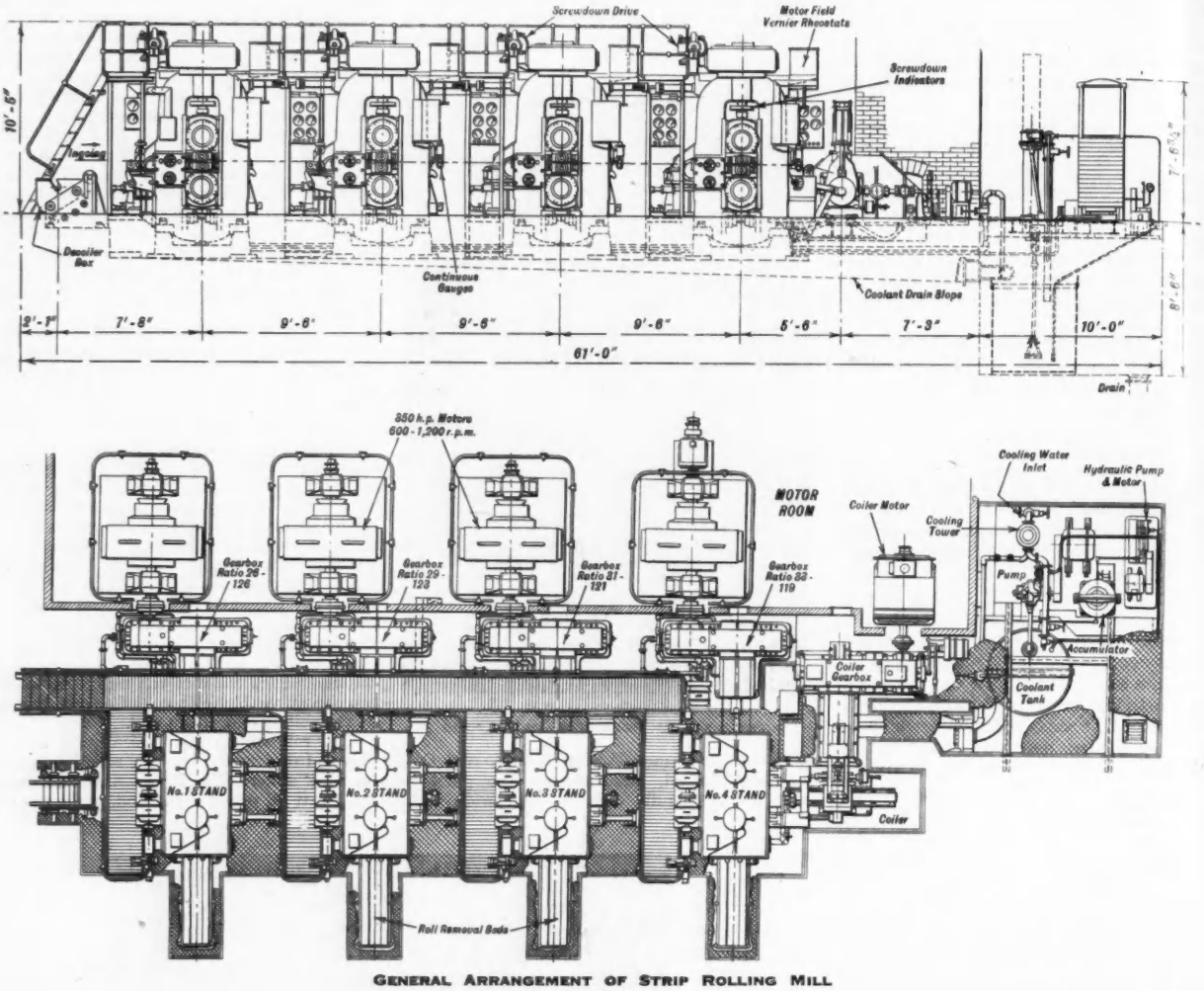
The roll stands are basically of the same size and design, the backing rolls being carried on SKF spherical roller bearings mounted by the Bratt oil pressure method, while the work-rolls are carried on SKF multi-row radial and thrust bearings. The electric screwdown gear fitted is of standard design, with one motor



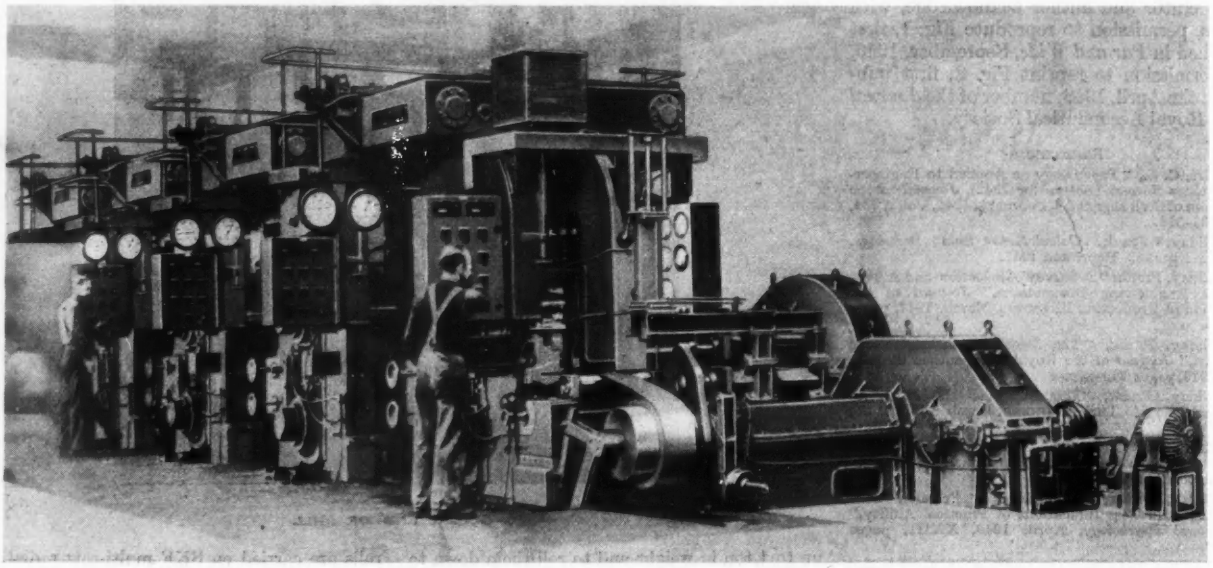
COILER END OF MILL

driving each screw, and the two motors on each stand can be coupled by a magnetic clutch for a dual operation. Ingoing guides have two large-diameter screws on each guide and these screws are inter-coupled by gears and splined shafts. Front and back guides are operated from outside the front housing by handwheels and the guide faces are formed of renewable brass strips. On stands 1 and 2 are fitted specially designed wiper presses, which have a self-feeding action and quickly changeable wiper faces.

Each stand has its own reduction gearbox, the rolls being driven through universal couplings from the pinion housing. In these gearboxes all the gears are double helical with continuous teeth. Each gearbox has an independent automatic lubrication system, to which the oil is supplied by a motor-driven pump. The lubrication system is fitted with pressure gauges and alarms so arranged that the operator will be immediately notified of any fault. Should an oil system fail, a light is automatically switched on in the mill and a hooter sounds. Four minutes after the warning is given the whole plant is automatically shut down. This four-minute interval gives



GENERAL ARRANGEMENT OF STRIP ROLLING MILL



FOUR-STAND TANDEM STRIP ROLLING MILL

sufficient time to clear the mill of a coil. The same warning devices operate should there be a failure in the water-cooling system used on the electrical installation.

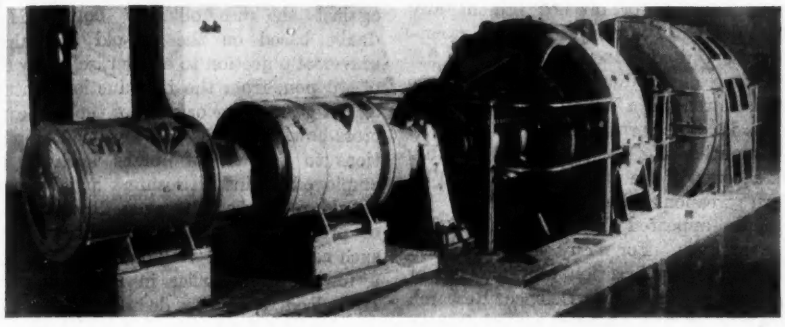
Roll balancing is effected by a complete hydraulic system, incorporating a motor-driven pump and accumulator, automatic switching devices and a pressure reserve being designed to keep the rolls open when the plant is standing for a long time without attention, such as during holidays and week-ends.

The dual cooling system used includes pads fitted to all the rolls. Through these pads the coolant is circulated and high pressure sprays are arranged to direct a stream of coolant on to the rolling point. Coolant is continuously recirculated around a closed system, passing through a heat exchanger, in which cooling water is circulated. The expected heat dissipation at a maximum working rate amounts to one million B.Th.U. per hour. As with all continuous mills, it is desirable that roll-changing shall be simple and quick. The work rolls are changed by porter bar, and a complete set of rolls and chocks can be quickly replaced by the use of a sliding carriage, which is fitted at each stand.

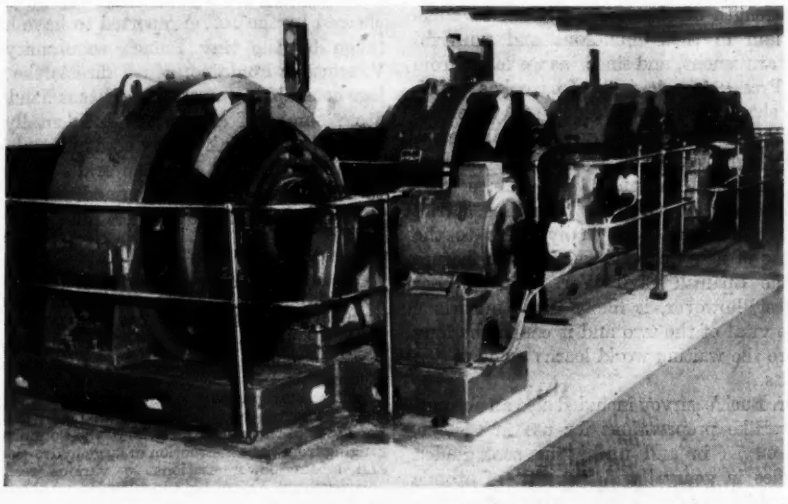
Particular care was taken in the design of the coiler equipment to give ease of handling. In this equipment all the handling devices are pneumatically operated and are under the control of a single lever. The air valves actuated by the lever are interlocked so that each mechanism can be operated only in its correct sequence and when moving the lever in the correct direction.

The coiler drum is 18in diameter and is of the automatic expanding and collapsible pattern, which expands on running the drum forward. The drum is carried on a large shaft and its outer end is supported by an outboard bearing. This outer end of the coiler is shown in one of the illustrations on page 345, in which the various handling mechanisms can clearly be seen. The coiler gear includes a push-off gear, a holding-on device for supporting the tail-end of the strip while banding, an air brake for expanding and collapsing the drum, and a belt wrapper gear, which retracts into the floor. There is no slot in the drum and strips up to 0·110in can be handled by the belt blocker.

The coiler is independently driven through a double reduction gearbox by a d.c. motor and this gearbox, like those of the roll stands, has its own self-contained lubrication system, complete with automatic pressure and warning devices. The coiler is equipped with the English Electric Company's system of constant tension control and is capable of providing tensions up to a maximum pull of 5000 lb and maintaining any pull within a margin of 3 per cent. The tension control system holds the coiler motor armature current constant at a preset value by an automatic regulator, and the circuits are so designed that even if the mill comes to rest tension is still maintained, but at a reduced level to hold the strip taut. Continuous gauging of the strips at stands 2, 3 and 4 is effected by Taylor, Taylor and Hobson, Ltd., flying micrometer equipment.



WARD LEONARD SET FOR ROLLING MILL



FOUR MAIN MILL MOTORS

All the control switches are mounted in cabinets hinged to the mill housings on the operating side. On the drive side other cabinets carry the essential electrical indicating meters and lamps. These control cabinets also carry the roll-setting indicators, which are of the cyclometer type and employ Selsyn transmission from the mill headgear.

A general plan of the lay-out of the mill and motors is shown in the drawing on page 346. All electrical gear, including the mill motors, is situated in a separate enclosure. Wellman Bibby couplings arranged in openings in the dividing wall connect the motors to the gear-boxes. The openings are closed in with sheets, which are made a close fit around the coupling rims. One of the photographs reproduced shows the four main mill motors. The small machine driven by No. 4 stand motor is an exciter for the coiler control system. The electrical equipment was supplied by the English Electric Company, Ltd., Stafford.

The four 350 h.p. mill motors are connected to a common busbar fed from the main d.c. generator. Individual variation of motor speed to conform with the reduction of the strip is attained by adjustment to the field currents. The main control is effected by a pilot-motor operated rheostat, the vernier adjustment of which is made through a hand-wheel situated in a convenient position for the operator. When rolling the need for speed adjustment is indicated by the strip tension meters already described.

Another illustration shows the main Ward Leonard generator set from the d.c. end. The units from the left are—coiler exciter, mill motors exciter, d.c. generator, a.c. driving motor. At the far end can be seen the starting panel for the a.c. motor. The control of mill speed is effected by the Ward Leonard system. The speed range obtained by field weakening on the mill motors also gives some measure of common speed control on certain rolling programmes, with higher torques available at the lower speeds, but this speed range is, of course, primarily required for determining the speed relationships between stands for the changing rolling programmes.

The control gear, we are informed, has been found very easy to operate. Charts have been prepared for the rollers' use showing the correct speed setting for any range of reductions within the working capacity of the mill. It has been found that by using these charts the rolls can be set very quickly and accurately prior to rolling. When rolling, only minor adjustments, as indicated by the tension meters, have been found to be necessary. The mill was commissioned last November. We learn that the operators now no longer use the screwdown gear for minor gauge adjustments to the strip. Any discrepancies in the gauge of the incoming material are corrected by variation of tension and the operators use the flying micrometers and the tension meters only as their guides in rolling. It has been found quicker to correct bad gauge material in this way than by the adjustment of the screws.

British Standards Institution

All British Standard Specifications can be obtained from the Publications Department of the Institution at 28, Victoria Street, London, S.W.1.

SIMPLE BEND TEST

No. 1639 : 1950. The material contained in this standard was originally intended for the use of committees of the Institution as guidance in preparing specification requirements for a simple bend test, but as there were indications that a wider dissemination would be appreciated, it was decided to publish it in the general series of British Standards as "Notes on the Simple Bend Test." Although the simple bend test is widely used to give a ready qualitative assessment of the ductility of a metal, it is not generally appreciated that certain features of the test, probably because of its simplicity, have to be given due consideration when the precise form of the test is being decided, or when the value of the test is being assessed. It is hoped that these notes will be of assistance in this respect. The publication is complementary to the bend test clauses of B.S. 485, "Tests on Thin Metal Sheet and Strip (not exceeding 0·128in (10 S.W.G.) in thickness)," but it is recommended that the provisions of that standard should be followed when testing thin metal sheet and strip. It does not, however, refer to composite or welded metals. Price 2s.

FRICTION SURFACE RUBBER TRANSMISSION BELTING

No. 351 : 1950. A revision of the war emergency issue of this standard has just been issued. The document provides four fabric weights for use in the construction of belting, and gives full constructional details and test requirements. It also incorporates appendices dealing with service conditions. Price 2s. post free.

THE ENGINEER

OCTOBER 6, 1950

VOL. CXC No. 4941

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NOTICE TO READERS

All letters intended for insertion in THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

No undertaking can be given to return drawings or manuscripts; correspondents are therefore requested to keep copies.

For Subscription Rates, see page 2 of Advertisements.

PRINTING DIFFICULTIES RECUR

IN the first weeks of last month the printing of trade, technical and certain other publications in the London area was brought very nearly to a standstill by a dispute between the London Society of Compositors, one of the printing unions, and the London Master Printers' Association. As far as we were concerned our issue of September 8th was wholly, and that of September 15th had partly to be, put together by our printers' apprentices. But in the latter of those two issues we felt able to congratulate the Association and the Society on their "sensible decision to conduct negotiations on the original matters in dispute.....in a more peaceful atmosphere." For the Society had withdrawn, in addition to a ban on the working of overtime, operative since May, certain recently applied rules restrictive of the way in which its members should work. Those rules, the members of the Association had considered, made it impossible for them to carry on their businesses effectively; and in consequence they had summarily dismissed their compositors for breach of contract.

Unfortunately we offered our congratulations too soon. Those negotiations "in a more peaceful atmosphere" to which we referred almost at once broke down. The Society replaced its ban on overtime and put again into force the objectionable restrictive rules. The members of the Association have therefore again dismissed their men for breach of contract. In short we are back where we were. This issue has been partly put together by our printers' apprentices and it is likely that the appearance of next week's issue will depend upon their co-operation. In the meanwhile a Court of Inquiry is examining the situation; and there is some hope of a return to normality when it reports its findings within a few days time. But, as its findings are not legally binding it is not certain that, even then, the dispute will be ended. We regret therefore that through no fault of ours and for a period which we can only hope will be short, issues of THE ENGINEER are likely to remain very substantially smaller in editorial and advertising content than is usual.

MODERN ARMS

IT is natural in these days that most governments should show a modest reluctance to divulge information respecting recent developments in their types of armament, whether they do or do not present any marked degree of novelty. The one exception is the United States, where, in the full consciousness, no doubt, of its immense potential strength, a certain degree of publication is still permitted. Thus, in the early months of this year a remarkably frank account of the various forms taken by modern weapons that came within his experience appeared from the pen of Dr. Vannevar Bush. For many years Dr. Bush occupied the key position of Chairman of the American National Defence Research Committee, as well as being an adviser on the Atomic Energy project, so that all he had to tell came with very high authority. What he wrote included a specially important section dealing with the modern technique of land warfare, which, in view of the situation reached in Korea, has particular interest at the present time. For it foreshadowed the inclusion in American armament of an anti-tank recoilless-gun, firing a projectile with a "shaped charge," of such effectiveness as would, in his view, cause any tank wandering aggressively through a country effectively supplied with these weapons to have but a short life. Since the main aggressive strength of the North Korean invaders has lain in their numerous and powerful tank armament, and since, as we learn from the Press, American 3½in bazookas which fire shaped charges able to penetrate the thickest armour any tank can carry, have been arriving in South Korea, a duel of immense technical importance has been fought out. The situation carries one's mind back over many years to the testing of new weapons which was a feature of the Spanish Civil War. The present contest, however, is likely to be much the more vital of the two and it cannot be long before the waiting world learns some of the results.

Dr. Bush's survey included also an account of warlike preparations for use in the air, as well as in and under the sea, guided missiles in general and the uses of atomic energy in any of its many forms. Atomic energy as an explosive in bombs is not likely to be employed in the Korean struggle, as the conditions hardly appear to be appropriate. Moreover, the raw material is far from being in large supply, and is at present needed for the building of a sufficiently large stockpile of atom bombs to deter any more ambitious attempt at aggression. For the choice of fillings to be used in aircraft bombs there is the alternative between the ordinary H.E. bomb and the Uranium bomb, and some day, conceivably, the Hydrogen bomb also. But there is apparently some division of military opinion as to where a line of effectiveness is to be drawn between the use of these possible explosives. From the purely military point of view it may be said that the Uranium bomb is some ten times as big as the most efficient size, and the H.E. bomb about 100 times too small, whilst the hydrogen bomb may turn out, if in the event it appears physically possible that it can be made at all, 1000 or even 10,000 times too big. It follows that if the sole guide be military efficiency the line of demarcation would be so drawn as to exclude the hydrogen bomb, though not the other forms of the atom bomb. Much of the popular feeling against the use of new bombs is no doubt based on the age-old and almost universal objection to any entirely new type of weapon, from the introduction centuries ago of gunpowder or even of the still earlier cross-bow. Those with sentimental objections to the use of bombs such as were employed against Hiroshima and Nagasaki, should remember the even deadlier effects of previous raids with incendiary bombs, such as the devastating one on Tokyo made a few months earlier in that same year. If, indeed, a line of demarcation is to be drawn at all between what should or should not be permitted, it would seem that an appropriate place for it would be one which would exclude any form or type of "area bombing" by any means whatsoever.

Though a good case can be made for the banning of such a device as a hydrogen bomb, militarily inefficient and civilly useless, it does not extend to the banning of the older forms of atom bomb. Indeed on the high authority of Mr. Churchill, the safety of the West partly rests on the considerable stockpile of such bombs held by the U.S. Government. If those who regret this situation feel gloomy thereat, they may be cheered by the action reported to have been taken by the tiny French community of Vaucluse-la-Fontaine, which directs the village constable to arrest any citizens handling atom bombs of any sort! Incidentally, it is pleasing to think of any community being so sufficiently rich in this world's goods as to be likely to traffic in commodities costing not less than a million dollars apiece.

CORRECTION.—In the description of the Vickers Tractor in our issue dated September 22nd, the maximum governed engine speed was given erroneously as 120 r.p.m., and should have read 1800 r.p.m.

POWER SUPPLY IN ONTARIO, CANADA.—The Hydro-Electric Power Commission of Ontario has recently issued a report of its activities for the year 1949. The report is well illustrated and gives a good idea of the many activities of the Commission, ranging from the construction of large hydro-electric and steam power stations to various research activities. The year 1949 is regarded by the Commission as its year of greatest achievement, there having been a peak in construction activities and also in the extension of power supplies to rural areas. One of the most interesting works being undertaken by the Commission during the year was the conversion of the supply in the Niagara division to a standard frequency of 60c/s. More than 150 municipalities have requested assistance in standardising the frequency of their systems. Completion dates of several projects under construction during the year were advanced owing to increased activity. Hydro-electric projects were under construction at Des Joachims, La Cave, Chenaux, Tunnel and Pine Portage, and two steam plants were under construction at Windsor and Toronto. At the end of the fiscal year the Commission had in operation fifty-eight hydro-electric stations, which, together with minor diesel stations, produced about 9450 million kWh during the year.

The Fifteenth Commercial Motor Show

No. II (*Continued from page 331, Sept. 29th*)

WE begin our account of the more interesting technical developments with a short review of the goods vehicles, where there have been comparatively few advances. The basically sound design of these vehicles generally persists with small variations, introduced during recent years, for the benefit of manufacturers and users alike. Nevertheless, there are some special purpose vehicles and trailers on show which testify to the ability of their manufacturers to cater for unusual transport requirements, especially those met in undeveloped territories.

Not for reasons of its abnormal size alone, but also because of its many unusual technical features, the six-wheeled "Mighty Antar" tractor, of Thornycroft, Ltd., is of outstanding interest. It has been designed primarily as a tractor to meet the desert transport requirements of the Iraq Petroleum Company and, under normal operating conditions, these articulated outfits provide a gross laden running weight of up to 100 tons. They are also suitable for use as solo vehicles to carry gross loads of up to 32 tons.

The "Mighty Antar" is powered by a 250 h.p. Rover "Meteorite" oil engine, having eight cylinders of 18 litres capacity, arranged V-wise in two banks of four cylinders, inclined at 60 degrees. Outstanding features in its specification include hydraulic power-assisted steering, a four-speed main gearbox and three-speed auxiliary box, double-reduction bogie axles, a braking system employing air-pressure operation, an engine cooling embodying twin radiators of 24-gallon capacity, and 14·00 by 20in, 20-ply tyres. Installed transversely behind the cab are two 100-gallon fuel tanks, which adequately provide for this vehicle's fuel consumption of about 4 road miles per gallon. The design of the "Antar" was fully described and discussed in our issues of April 28th—May 19th 1950.

Scammell Lorries, Ltd., was showing a six-wheeler with drive to all six wheels. This six-wheeler, known as "The Explorer," is powered by a Meadows six-cylinder diesel engine of 10·35 litres capacity, developing 130 h.p. at 1900 r.p.m. (Fig. 1). It is fitted with a six-speed constant-mesh gearbox, in which the sixth gear is an overdrive and contains a power take-off drive to a vertical, spindle-type winch. The rear axle drive is through a worm and wheel assembly to a train of gears in each of the side cases, the wheels being mounted on stub axles at each of the four extremity gears. The front axle is driven by double-reduction, spiral-bevel and epicyclic gearing, which can be engaged when required. Compressed-air assistance is used for steering and braking.

A four-wheeler, built by Latil S.A., with all wheels both driven and steered, designed as a special purpose tractor, embodies many interesting features, such as a four-speed gearbox and a two-speed transfer case. Transmission takes place by open propeller shafts through differentials to internal-toothed pinion drives in the hub assemblies of all four road wheels. Controls are provided for locking the differentials if required, and the rear wheels can be locked in the straight ahead position when front-wheel steering only is required. The weight of the chassis with cab and all equipment is approximately 7 tons, and the tractor is capable of dealing with loads up to 40 tons.

Among the various goods vehicles seen at the stand of A.E.C., Ltd., was an interesting multi-wheel model (Fig. 2), this being an overseas version of the "Mammoth Major," Mark III, six-wheeler. Designed for 20-tons gross loads, this vehicle has a left-hand control, 18ft. 9½in wheelbase chassis, fitted with the 150 h.p., 11·3 litre direct-injection oil engine. An important point to overseas operators is that in common with all other A.E.C. left-hand control chassis, all auxiliaries are mounted on the right-hand side of the engine, so as to be accessible when the bonnet is opened.

The gearbox is of the five-speed constant-mesh type. Points of interest in this are the constant-mesh gear trains, which are used for second, third and fourth speeds, the particularly stiff large-diameter mainshaft and layshaft and the gear-type oil pump, which provides forced lubrication for the bushes on which the second, third and fourth speed mainshaft gear run. A small crank mounted on a rearward extension of the layshaft is used to drive the single-cylinder compressor for the air-brake system. A power take-off can be provided, which is capable of transmitting a torque of 1200 lb ft.

Again, in keeping with the special requirements of overseas, where vehicles frequently have to operate over rough terrain, this model is shown with a new fully articulated rear bogie, which is available as an alternative to the standard balanced beam type of rear suspension. The wheels on either side of the new bogie are connected to the ends of a single, reverse semi-elliptic spring, which is pivoted about its centre to a tubular pivot beam.

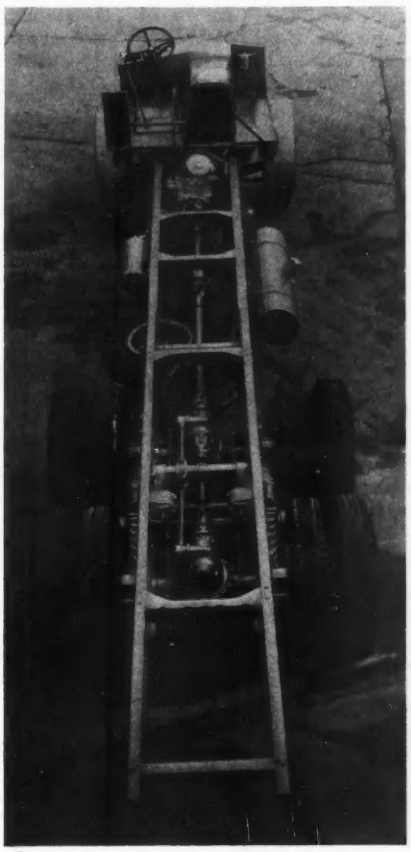


FIG. 2—"MAMMOTH MAJOR" 20-TON CHASSIS—A.E.C.

The double-drive rear axles incorporate overslung worm drives and a third differential, which balances the drive to the rear axles and is incorporated in the rear of the worm casing of the first axle. The fully-floating axle shafts have involute-sided splines at their inner ends and drive through involute teeth on integral flanges at the outer ends to the hubs, which are carried on taper-roller bearings. The standard balance beam type of suspension with either single or double-drive, is, of course, still available on this model. Compressed air is used to operate the footbrake on the leading front axle and to the two rear axles.

An impressive exhibit on the stand of Leyland Motors, Ltd., was the "Octopus" eight-wheeler, with a 1350 cubic feet capacity van body, by Thos. Allsop, Ltd. The chassis has a 17ft 9in wheelbase and is powered by a 125 h.p. diesel engine, the transmission being through a single dry-plate clutch, five-speed, heavy-duty gearbox, and through two open tubular propeller shafts to the double-drive rear bogie. The bogie consists of two identical rear axles, worm-driven with 9in centres and 7·33 to 1 reduction ratio, which are coupled together and

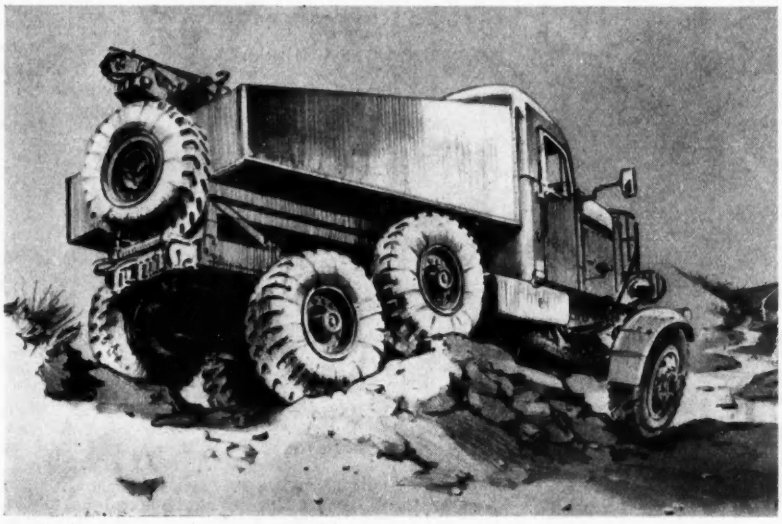


FIG. 1—THE "EXPLORER"—SCAMMELL

driven by a short Hardy-Spicer universal-jointed propeller shaft.

The axles are attached, by swivelling trunnions, to the ends of the inverted semi-elliptic springs, which are mounted on trunnion brackets supported by a tubular cross-member, passing through large brackets secured to the frame. Trunnion bearings each incorporate a large rubber bush that requires no lubrication. Suspension springs are secured to the trunnion-bearing housings by inclined "U" bolts. These pass over semi-circular clamping pads on the top of the spring assemblies.

The steering control of the second axle is effected by a connection from the steering drop arm to a relay lever pivoted on the frame midway between the axles and thence to the steering arm of the second axle.

At the stand of Atkinson Lorries, Ltd., a new tractor chassis for hauling loads up to 50 tons, was to be seen, several of which are now being built for use in South Africa (Fig. 3). It is powered by a Gardener eight-cylinder diesel engine developing 150 h.p. at 1700 r.p.m. The drive is taken through a five-speed gearbox and tubular propeller shafts to the worm gear bogie axles. The necessary low final drive ratio is provided by a planetary reduction gear housed in the wheel hubs.

On the stand of Vauxhall Motors, Ltd., the new big Bedford was a centre of attraction. By excellent balance and weight distribution, and by the use of new design features, Bedford engineers have succeeded in producing a full 7-tonner, which, in lorry or tipper form, weighs less than 3 tons unladen.

Of orthodox design, the chassis is powered by a six-cylinder petrol engine of 5 litre capacity, developing 110 h.p. at 3200 r.p.m. Some particularly interesting features of this new engine type will be discussed in a later issue.

Right from the inception of this new vehicle one of the major aims has been to avoid the faults common to many other forward control vehicles—serviceability and accessibility must not be sacrificed nor must driver comfort suffer, due to excessive heat. The heat problem has been solved by a system whereby a constant flow of cool air is sucked by the engine fan from the front of the vehicle and passed through a double-skin engine cowling. The rate of flow varies with engine speed so that cooling is increased with increased engine speed (Fig. 4). A three-point cab mounting in the form of rubber shear mounts gives effective relief to the all-steel cab structure when subjected to distortion on rough ground. The steering box, which is rigidly bolted to the frame and the column, is connected to the box through a fabric universal joint.

The drive is taken through a 12in diameter clutch to a four-speed gearbox. Top, third and second ratios have synchro-mesh arrangements and the third and second gears are of constant-mesh single helical form. A two-piece propeller shaft with an intermediate double-row ball bearing transmits the drive to the hypoid rear axle of orthodox design. In the hydro-mechanical braking system the shoes are operated mechanically at the front and mechanically at the rear. The

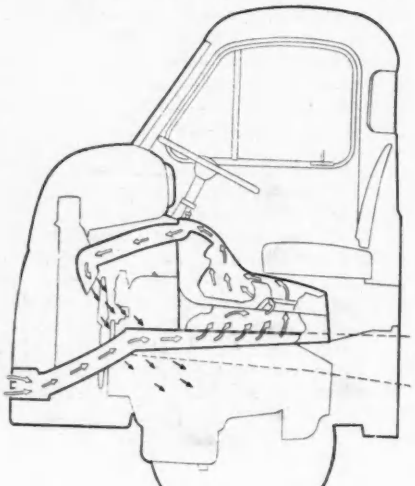


FIG. 4—CAB COOLING SYSTEM—BEDFORD

Lockheed brake master cylinder incorporates two pistons in tandem, one of them connected to the front axle and the other one to the rear axle, thus ensuring that the rear brakes remain in operation should there be any failure in the front hydraulic system.

Another interesting feature is the adoption of the pressure cooling of the engine, incorporating a pressure relief valve in the radiator fill-up cap. The system operates under a pressure of 3½–4½ lb per square inch, thus raising the boiling point of the water to 221—224 deg. Fah. and reducing the risk of boiling.

(*To be continued*)

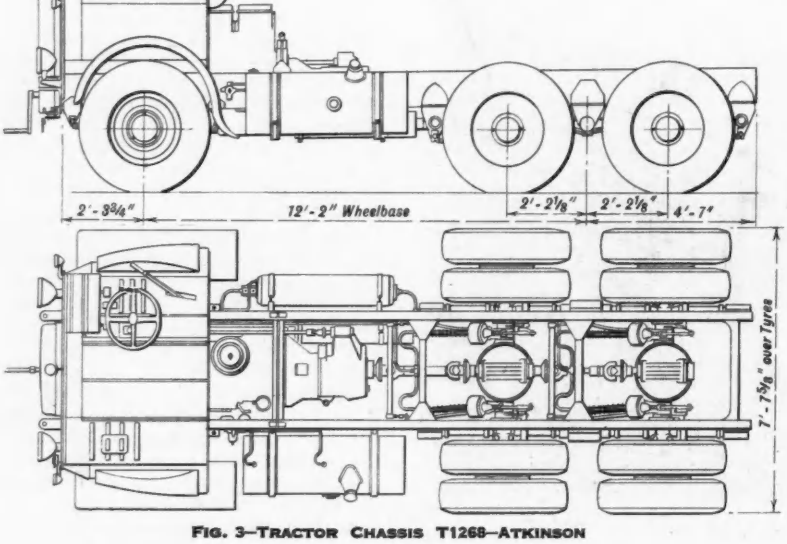


FIG. 3—TRACTOR CHASSIS T126S—ATKINSON

Literature

SHORT NOTICES

Early British Railways. By Christian Barman. 1950. (Penguin Books, Harmondsworth. Price 3s.—This attractive essay has been written by the Publicity Officer of the British Transport Commission for the general reader. Its purpose is to make him proud of British railways and the great pioneers, especially George Stephenson and the younger Brunel. It is concerned solely with the civil side of railway engineering and we cannot recall a word about locomotives and rolling stock. A number of coloured illustrations from sources familiar to railway students are included. The author's appreciations of the two great engineers we have mentioned is of the warmest, but we suggest that he has somewhat underrated George Stephenson's youth and overlooked the studies he pursued with his son. It strikes one as odd, too, that he never mentions Robert Stephenson, whose part in the civil engineering work of early railways is of the first importance. But one must not expect too much in an essay of less than 12,000 words. Mr. Barman, ranging over a wide field, has given us a little volume that may be read with pleasure as well as profit.

Wireless at Sea: The First Fifty Years. By H. E. Hancock. Marconi International Marine Communication Company, Ltd., Chelmsford. Price 15s.—This book is published to mark the jubilee of the Marconi International Marine Communication Company, Ltd., and is, in effect, almost a complete history of the development of marine wireless. The early experiments of Marconi are recorded and an account given of the demonstrations made before scientific societies and Government departments, and recalls the prejudices and antagonism which had to be surmounted before it was generally acknowledged that messages could be transmitted over considerable distances without the use of wires. The gradual adoption of the system is traced and also the slow realisation of its value, which was hastened by a number of events, both dramatic and tragic, which had the effect of making the equipment compulsory on ocean-going vessels. The effect of wireless upon shipping affairs and management are described, and the production of additional radio aids to navigation, such as the direction finder and the latest device, radar. Chapters tell the history of wireless during two world wars and of the sacrifices and devotion to duty of radio officers. The book gives an account of the gradual building up of a world-wide organisation supplying equipment and providing a maintenance and spare part service. "Wireless at Sea" is well illustrated by photographs, both historical and topical and tells a fascinating story of the first fifty years which puts on record an endeavour unparalleled in world history.

BOOKS RECEIVED

Electrical Engineers' Handbook.: Electric Power. Fourth edition. London: Chapman and Hall, Ltd., 37, Essex Street, London, W.C.2. Price 68s.

Modern Welding Technique. By E. T. Gill and Eric N. Simons. London: Sir Isaac Pitman and Sons, Pitman House, Parker Street, Kingsway, W.C.2. Price 21s.

Mechanics Via the Calculus. By P. W. Norris and W. Seymour Legge. Third edition. London: Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 16s.

Gear Cutting Practice. By Fred. H. Colvin and Frank A. Stanley. Third edition. London: McGraw-Hill Publishing Company, Ltd., Aldwych House, Aldwych, London, W.C.2. Price 40s. 6d.

Aluminium Strip Mill at Rogerstone

No. II—(*Continued from page 322, Sept. 29th*)

Cold Finishing Lines

SEEN in the accompanying illustration, the three-stand tandem cold mill, sited at the beginning of the cold finishing lines, consists of a mill built by the United Engineering Company, United States of America, flanked by mills supplied by Davy and United Engineering Company, Ltd., and powered by the British Thomson-Houston Company, Ltd. The unit can handle coils weighing up to 4000 lb and varying from 20in to 56in in width. Ingoing thickness must lie between 0·08in and 0·20in, and the outgoing between 0·01in and 0·064in, the reduction in one pass lies between a maximum of 0·14in to 0·016in, and a minimum of 0·10in to 0·04in.

Supplied by Hadfields, Ltd., the forged alloy steelwork rolls of 18in diameter weighing 4 tons, and the forged steel back-up rolls of 49in diameter, weighing 37 tons, are all 66in long, and the work rolls are set $\frac{1}{8}$in forward of the back-up rolls. Housings are of cast steel and the cross-sectional area of the machined posts permit a safe roll separating force of 1800 tons and a maximum of 2800 tons. Each stand is driven by twin 1300 h.p., d.c. motors on the same shaft driving through forged high-carbon steel pinions running in Skefko bearings, No. 2 and No. 3 stands are direct driven, while No. 1 stand is driven through a reduction gearbox. The mill speed at No. 1 stand is between 540ft to 1080ft per minute, at No. 2 stand it ranges from 943ft to 1886ft per minute, and at No. 3 stand it varies between 1320ft to 2120ft per minute. The roll balance system is hydraulically operated, a pressure of 1500 lb per square inch being used.

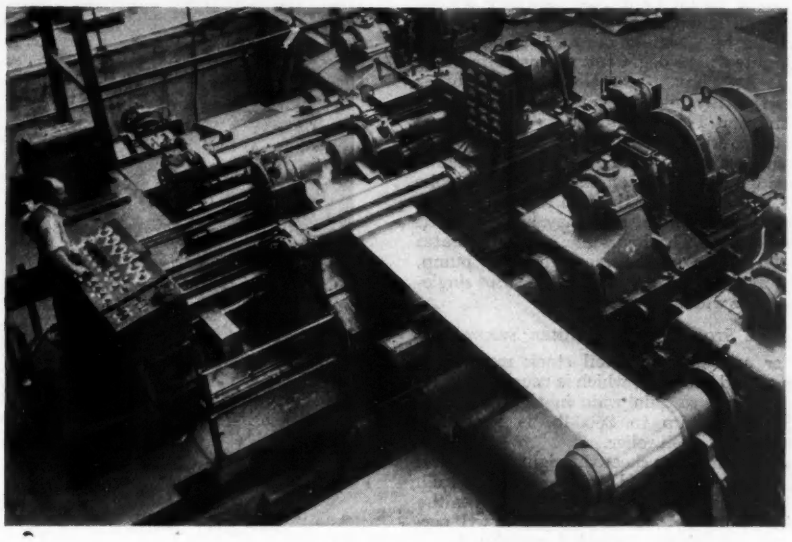
A paraffin-base oil cools and lubricates the rolls and it is circulated by two Pulsometer single-stage, double-inlet, centrifugal pumps, each delivering 900 gallons per minute at 100 lb per square inch to banks of flat jets at which a pressure of 80 lb per square inch is maintained. Arrangements are provided for cooling and cleaning the oil and three Pulsometer pumps each deliver 900 gallons per minute at 50 lb per square inch from a 9000-gallon dirty oil tank through strainers to a 12,000-gallon clean oil tank. Working on the by-pass principle there is a fine filtration system in which a pump passes clean oil at 250 gallons per minute against a head of 120ft through gap wire-wound strainers to a 2500-gallon tank and three 100 gallons per minute, 120 lb per square inch pumps return the oil to the clean oil tanker through filters.

Six coils at a time are loaded on to conveyors which lead to the cold mill and one coil at a time is released to a spragging machine to have a tail formed which is lengthened in a reversible roller leveller. On the ingoing side of each stand is a roller tension bridle and tachometers, and flying micrometers record speed and gauge after leaving each set of rolls. After leaving No. 3 stand the strip is fed over a deflector roll on to a tension reel driven by two 400 h.p., d.c. motors, and when the coil is formed it is stripped and banded.

Building Sheet

Material intended for building purposes is conveyed to the 60in heavy shear line, supplied by W. H. A. Robertson and Co., Ltd., which can produce flat sheet 56in wide and corrugated sheet 32in wide, the maximum length being 20ft. The coils are unwound and passed through a leveller and a rocking beam flying shear, these machines dealing with strip 56in wide and between 0·022in to 0·064in thick at 300ft per minute, the sheared lengths ranging from 30in to 20ft. The cut sheets are separated on an accelerating table having a belt of reinforced oil resisting rubber, and the flat sheets are stacked directly. Those to be corrugated are passed to a belt conveyor, then over a table of hardened steel rollers skewed at an angle of 5 deg., and through guides to a corrugating machine consisting of series of forming rolls driven by a 25 h.p. motor.

The coils remaining after removal of the building sheet are edge trimmed to final width and slit into two or more strips. Our illustration shows the slitting machine which was supplied by Head Wrightson, Ltd. It has rotary knife cutters driven by a 40 h.p. motor and is designed to deal with sheet having a maximum width and thickness of 56in and 0·064in respectively, and to give four simultaneous cuts at 1000ft per minute. The machine is fed from a pay-off reel 61in long driven by a 75 h.p., d.c. motor, and has two tension reels provided with belt wrappers. No. 1 reel is 61in long and powered by a 75 h.p., d.c. motor, and No. 2 is 53in long, driven by a 40 h.p., d.c. motor. Hydraulically operated strippers eject the completed coil or empty spool.

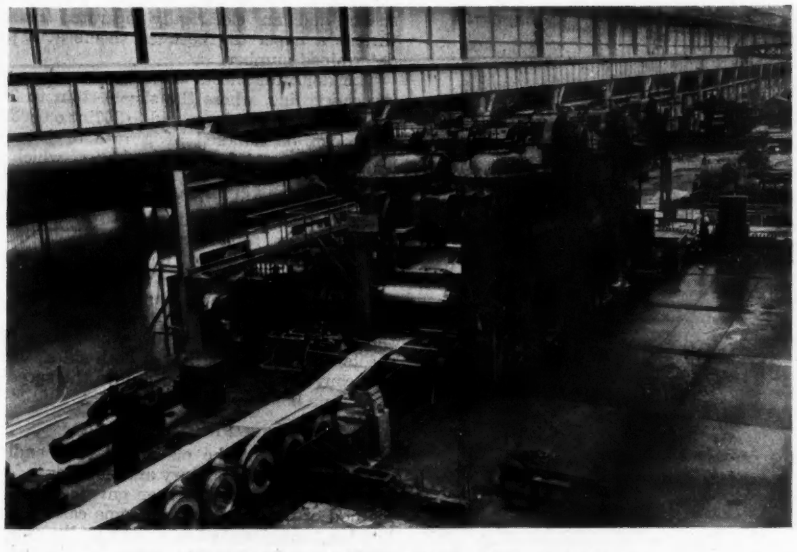


Slitter Used as Edge Trimmer

Circles for Hollow-Ware

Coils for circles are usually slit into strips 8in wide and are transferred to the circle line, where they pass to the uncoiler, which has a strip feed speed range of 50ft to 200ft per minute, and then through a leveller, which can take strip up to 8in wide by 0·038in thick at 200ft per minute, before moving on to the instrument stand. This is fitted with a foil gauge, by Electronic Instruments, Ltd., having a thickness range of 0·01in to 0·05in, and when the strip thickness exceeds the allowed tolerance the instrument transmits an impulse which operates a scrap gate. The correct gauge material is fed to the blanking press, which can blank 500 3in diameter discs or 250 8in diameter discs per minute. Twin 100ft per minute conveyors take the discs in two parallel lines to the inspection point, and via an accelerating table and band conveyors, equipped with electronic counters, to the piler tables through solenoid-operated gates.

Cold rolling of aluminium hardens it and reduces its ductility, therefore foil stock and container sheet, which require further cold working, must be softened by annealing at a temperature of approximately 400 deg Cent. for a period and then cooled in a manner determined by the alloy. The coils are hydraulically loaded two high into the furnace, which can accommodate 140 coils in seventy trays and



Three-Stand Tandem Cold Rolling Mill

has a capacity of 7½ tons per hour. Hot air is the heating medium and has a maximum temperature of 500 deg. Cent. in the pre-heating zone and 560 deg. Cent. in the soaking zone.

A 70 h.p., 40in diameter Sirocco induced draught fan, with a capacity of 25,000 cubic feet per minute at 225 deg. Cent against 7½in water gauge, serves the pre-heating zone and the soaking zone has a 70 h.p., 41½in diameter Sirocco fan handling 28,000 cubic feet per minute at 360 deg. Cent. against 6in water gauge. Each pre-heating zone is 37ft 9in long and holds ten trays, while the soaking zone chambers are 41ft 6in long and each hold eleven trays.

Using a mixture of producer and coke-oven gas, the low-pressure turbulent burners, four of which are fitted in each combustion chamber, consume 60,000 cubic feet per hour. Air is supplied at 3000 cubic feet per minute against 7½in water gauge by a 16in diameter Sirocco blower fan and the combustion products are exhausted by a similar fan at 6000 cubic feet per minute at 180 deg. Cent. against 1½in water gauge. A 30 h.p., 10-ton electric screw pusher moves the trays along a conveyor track and a Fielding and Platt hydraulic extractor draws them to the cross-haulage traverse car. Opposite each furnace twin Fielding and Platt hydraulic loaders exerting a 35-ton thrust over a stroke of 6ft, push the trays through the furnace one tray pitch at a time, and they are extracted hydraulically. The hydraulic system operates at 2400 lb per square inch and the pump, driven by a 70 h.p., a.c. motor, has three single-acting rams with a 3ft stroke.

Foil Stock and Container Sheet

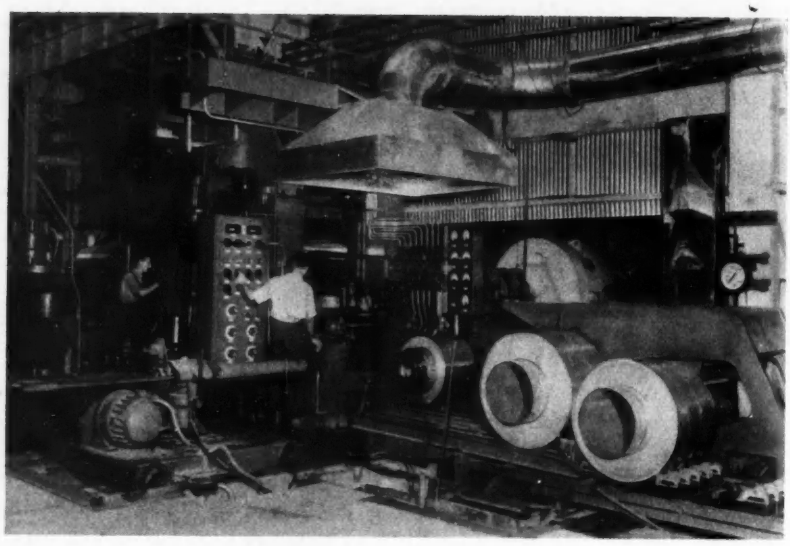
After annealing, the foil stock material is diverted and the strip, which is usually 0·018in thick and up to 28in wide in tightly wound coils weighing up to 2000 lb, is ready for despatch to the foil roller.

To give container sheet the right mechanical properties it is passed to the temper mill, which is illustrated here, where it is given the required temper by rolling to a selected percentage reduction. Manufactured by Davy and United Engineering Company, Ltd., the four-high, non-reversing mill rolls strip 14in to 30in wide from a thickness ranging from 0·04in to 0·01in down to a thickness lying between 0·016in and 0·007in at 2000ft per minute, the maximum reduction in one pass being from 0·04in to 0·016in and the minimum from 0·01in to 0·007in.

Work rolls 12in diameter and back-up rolls 32in diameter are both 36in long and of forged alloy steel. Timken double-row tapered roll bearings carry the roll journals and the closed-top housings are of cast steel and suitable for a roll separating force of 500 tons on the four posts. Hydraulic cylinders in the bottom chocks balance the upper rolls, the pressure in the system being 1500 lb per square inch. The drive is by a 1000 h.p., d.c. motor, which is rated to take frequent 100 per cent momentary overloads.

For cooling and lubrication a white-spirit-based oil is used; it is delivered to sprays on the ingoing side at 450 gallons per minute and 100 lb per square inch, and, if necessary, two Serck coolers can be included in the circuit. There is a 4000-gallon dirty oil tank from which a pump passes the dirty oil through a wire-wound strainer at 450 gallons per minute and 50 lb per square inch to two 8000-gallon strained oil tanks, these being fitted with a by-pass fine-filtering system. Air blasts on the outgoing side blow off as much oil as possible. A five-roller bridle is provided on the ingoing side, and on the outgoing the strip thickness is measured by a flying micrometer or a radiation gauge, which employs radio-active thallium 204, before it passes over a deflector roll to a Head Wrightson reel driven by a 220 h.p., d.c. motor. Tension in the strip is maintained at between 500 lb to 4000 lb between the reel and the mill rolls.

From the temper mill the coils are transported to the two light shear lines, where they undergo a number of operations. The coils are transferred from a slat conveyor to a 75 h.p. uncoiler reel fitted with a 45in stroke air-operated stripper. Subsequently the leading and rear ends of following coils are automatically spot welded together; each welding unit has a welding current of 21,000A and can join aluminium strip up to 0·038in thick. Constructed entirely of aluminium alloy the wash box is 14ft 6in long, 23ft high and 40in wide, and is divided into eight vertical air-tight compartments through which the strip passes alternately up and down over 16in diameter cambered steel drums at top and bottom. This degreasing plant removes excess rolling oil, but leaves the right amount of oil on the surface to provide lubrication for further operations at the customers' works. Three 2ft diameter drums at the exit end provide the drive and two neoprene covered pinch rolls at the ingoing end maintain tension.

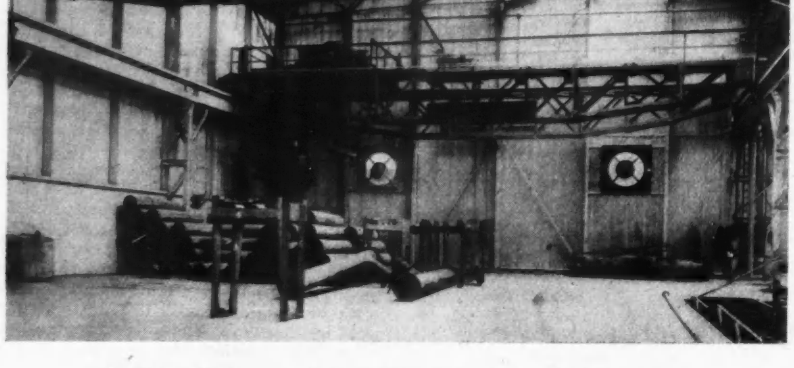


Four High Temper Mill

After edge trimming the strip thickness is checked by a continuously measuring gauge, which automatically arranges for the rejection of defective material as separate sheets at a later stage. A Hallden synchronised rotary automatic flattening and shearing machine cuts the strip into flat sheets varying in length from 18in to 37½in at speeds from 200ft up to 600ft per minute.

The cut sheets are carried forward to the classifiers where diverging conveyors segregate the finished sheets into three piles by means of two solenoid-operated diverter gates. Scrap sheets are directed to a lower conveyor by the first gate and the second gate divides the doubtful from the accepted sheets. During piling side guides and end stops position the sheets and an electrically operated marker thrusts a paper tag between sheets at a pre-determined number.

The doubtful sheets are transported to the inspection line, where the sheets, 14in to 36in wide, 18in to 37½in long, and 0·007in to 0·038in thick can be handled at a rate of between fifty to seventy-five per minute, which is about six times as fast as manual handling. At the de-piler a blast of air separates the sheets and suckers at the front edge carry one sheet at a time on to a forwarding roller, thence down to the lay board, and then a conveyor moves it to the inspection wheel. With arms protected by whalebone, and rubber pads on the boss to cushion and to prevent damage to the sheets, the 6ft diameter wheel turns the sheets over for inspection of both sides. Split belt conveyors shingle and reduce the speed of the sheets before piling.



15-Ton Aluminium Alloy Cranes in Cold Finishing Bay

Mechanical Handling

The lay-out of the plant and the handling scheme are complementary and interdependent, so that the lay-out has been governed by the method of handling, and, in some cases, handling has been designed to suit fixed dispositions of plant. An essential part of the whole

scheme, the handling system as devised had to satisfy certain main considerations, such as ability to maintain even flow of material from point to point, flexibility of operation, dependability and the use of the minimum of manpower.

Mainly concerned with the handling of coil of 4000 lb maximum weight, the system, in addition to using conveyors, employs aluminium alloy lifting beams to carry six coils. The beams have been specially designed for transport by overhead crane and are operable by the crane driver without assistance from the floor, and stillages have been laid out to suit these appliances.

A feature regarding the various cranes, which can be noted in our illustration, is the extensive use of heat-treated aluminium alloys, having an ultimate tensile stress of about 25 tons per square inch, for the construction of the crane girders and resulting in a considerable saving of weight. The mill is well equipped with cranes, all of which have d.c. motors fed by downshop leads, and their main particulars are listed above. With the exception of the crane serving the ingot store, which was manufactured by Sir William Arrol and Co., Ltd., all the cranes have been built by Wellman Smith Owen Engineering Corporation, Ltd.

Rolling Mill Cranes

Service	Load	Span	Material	Weight	Equivalent weight in Steel
	Tons	Ft. in		Tons	Tons
Scalping bay	10	70 0	Aluminium alloy	15·0	22·5
Ingot store	10	56 3	,,	13·25	20·0
Preheating bay	5	35 0	Steel	—	—
Hot line	55/5	70 0	,,	—	—
Hot line	10	60 0	Aluminium alloy	12·5	21·1
Roll grinding bay	40/10	37 6	,,	23·0	30·0
No. 1 finishing bay	40/15	—	,,	29·8	40·3
,, ,,	15	56 3	,,	17·8	28·0
,, ,,	5	56 3	,,	8·8	14·3
No. 2 finishing bay	15	56 3	,,	17·7	27·8
,, ,,	15	56 3	,,	17·7	27·8
,, ,,	5	56 3	,,	8·8	14·3
Remelting shop	10	41 6	—	—	—

Made of solution-treated and fully heat-treated aluminium alloys, the ingot handling beams are suitable for ingots up to 8 tons in weight, varying from 20in to 60in in width and up to 126in in length, and can accommodate a stack of ingots 36in high. One beam serves the ingot store and the other the scalping bay. Aluminium alloy grabs weighing about 230 lb cater for ingots up to 2 tons in weight, and larger sizes weighing over 800 lb deal with 6-ton ingots at the scalping machine.

Three coil-lifting beams of fully heat-treated aluminium alloy plates and sections with cast aluminium alloy fingers are in the hot roughing bay, two take six 4000 lb coils and the other four 4000 lb coils. Two beams of six coils capacity are provided in No. 2 finishing bay, two in No. 1 finishing bay, one being for empty steel spools, and two small beams are in use in the inspection department.

Elwell Parker battery-driven, 5-ton capacity fork lifting trucks assist in the transport of ingots to the scalping bay and the pre-heating furnaces, and 2-ton capacity fork lift trucks are in service in the packing and inspection area for the handling of container sheet or pallets. Finally, two 0–6–0 diesel locomotives, built by the Vulcan Foundry, Ltd., powered by a 204 h.p. Gardner engine, are available for shunting purposes.

(to be continued)

The Ironfoundry Industry

As recorded in our "Seven-Day Journal" last week, the Anglo-American Council on Productivity published, on September 20th, the report of the specialist team drawn from the grey ironfoundry industry. On the same day, the report was discussed at a conference of ironfoundry employers which was convened in London by the Council of Ironfoundry Associations.

The conference was addressed by Mr. Hermann P. Good, president of the Gray Iron Founders' Society, Inc., U.S.A., and members of the team responsible for the report were present to introduce the subjects for discussion and to answer questions. Mr. Good was able to supplement the answers, not only from his experience as president of the Gray Iron Founders' Society, but also as superintendent of the foundry at the Textile Machine Works, Reading, Pa., which was one of those visited by the team and described in the report. The conference closed with a session on the findings and conclusions of the report and means of implementing them. Those findings, accepted by the employers at the conference, have been summarised as follows :—

"The first and most important point on which agreement must be reached by management and workers is that a greater production per head is not only desirable, but essential, if Britain is to recover her economic status, and that in the ironfounding industry greater productivity is essential owing to the shortage of manpower.

"Government, management and workers must combine to rearrange the real rewards for everyone in Britain, so that the efficient may be well rewarded and the indolent may suffer some hardship. In the nation's present plight, productivity must override welfare traditions and ideologies.

"Means must be found to engender a stronger feeling of good will and trust between management and workers.

"Britain will require considerable acceleration in the equipment of secondary technical schools and a reorientation of the outlook of both teachers and of parents which, at present, magnifies the status of the secondary grammar school, and lowers the status of industry as compared with the professions or with 'black-coated' employment.

"Those British ironfoundries which have no costing system should emulate the Americans by installing, as a first step, a simple costing system.

"The simplicity of the American wage structure should be adopted in Britain."

The Council of Ironfoundry Associations has stated that it will take immediate action to pave the way of further implementing the findings of the report. This action will include :

Sending copies of the report and a report of the conference to all ironfounders in Great Britain.

Technical aspects of the report will be discussed at a conference at Ashorne Hill, Leamington, on October 12th and 13th. This conference is sponsored by the British Cast Iron Research Association. Members of the team will attend to introduce discussion and answer questions. The Institute of British Foundrymen will hold branch meetings throughout the country to discuss the report.

Constituent associations of the Council of Ironfoundry Associations will hold local meetings for employers.

The formation of local cost groups will be encouraged.

All ironfounders are being encouraged to join constituent associations in order that they may be kept in close touch with developments.

Advisory teams operating through the British Cast Iron Research Association will help ironfounders to improve productivity.

The development panel of the Council of Ironfoundry Associations will examine the report in accordance with its principal terms of reference, which are briefly "To examine problems of efficiency in both technical and management contexts, and to keep abreast of the best technical practice at home and abroad."

The problems of incentives and simplification of the wage structure will be investigated in consultation between the Council of Ironfoundry Associations and the Engineering and Allied Employers' National Federation and other wage negotiating bodies.

The adverse effect of taxation on the financial incentives intended to increase productivity will be impressed on the Government by the ironfounding employers at every opportunity.

The Council of Ironfoundry Associations will review the system of training and education in the light of the report and will submit early recommendations.

Canadian Engineering News

(By our own Correspondent)

Turbines for New Zealand

Two important orders for large hydraulic turbines have been awarded to the Dominion Engineering Company, Lachine, Quebec, by the New Zealand State Hydro-Electric Department. One order is for four turbines of 56,000 h.p., each under a head of 156ft, for the Roxburgh power-house on the Clutha River in the South Island. The other order comprises four units of 35,000 h.p., each under a head of 123ft, for the Whakamaru station on the Waikato River in the North Island. For both the stations the turbines will be conventional vertical-shaft, Francis runner machines and will be similar in design to those supplied by Dominion Engineering for many large Canadian power developments. While the greater part of these machines will be built in Canada, a substantial proportion of the manufacturing work will be done by New Zealand firms having suitable facilities.

New Explosives Plant

Canadian Industries, Ltd., announce the acquisition of approximately 1200 acres of land about 8 miles south of Calgary, Alberta, for the purpose of erecting a commercial explosives plant costing between 3,000,000 and 4,000,000 dollars. It will supply the rapidly expanding oil and mineral industries in Alberta and the North-West Territories. Plans for construction already are under way and about 100 persons will be employed when production first begins, possibly early in 1952.

Coal

Canada is expanding in her coal production, making new gains over output a year ago. It is reported that production over the first six months of 1950 totalled 9,588,600 tons, compared with 9,127,000 tons in the same period last year. This 5 per cent increase in production is helping Canada save dollars, for imports during the same period dropped 3 per cent. Most of Canada's imports come from the United States. It is estimated that 10,432,500 tons were imported in the six-month period, compared with 10,734,600 a year ago.

Diesel Locomotives

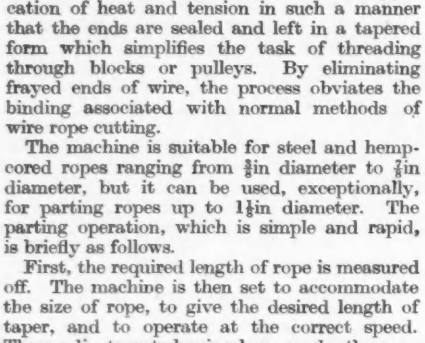
The Canadian National Railways have placed an order for twenty-two diesel locomotives, to cost approximately 2,500,000 dollars, with General Motors Diesel, Ltd., London, Ontario. The locomotives will be of 800 h.p. each, and, on their delivery, will be assigned to service in various parts of Canada. They are to be 115-ton switchers, powered by an eight-cylinder V-type diesel engine, and designed to cover yard, terminal and transfer requirements. The purchase of an additional number of this type of diesel locomotives is in conformity with the announced policy of the railway in applying diesel power to its transportation requirements. With the placing of this order the Canadian National will have in service 199 diesel locomotives.

Wire Rope Parting Machine

A MACHINE of novel design for parting wire rope has been introduced by British Insulated Callender's Cables, Ltd., Prescot, Lancs. This machine parts wire rope by the combined application of heat and tension in such a manner that the ends are sealed and left in a tapered form which simplifies the task of threading through blocks or pulleys. By eliminating frayed ends of wire, the process obviates the binding associated with normal methods of wire rope cutting.

The machine is suitable for steel and hemp-cored ropes ranging from $\frac{3}{8}$in diameter to $\frac{7}{8}$in diameter, but it can be used, exceptionally, for parting ropes up to $1\frac{1}{8}$in diameter. The parting operation, which is simple and rapid, is briefly as follows.

First, the required length of rope is measured off. The machine is then set to accommodate the size of rope, to give the desired length of taper, and to operate at the correct speed. These adjustments having been made, the rope is lowered into the machine and clamped in



WIRE ROPE PARTING MACHINE

the contact grips provided. A heavy electrical current, at low voltage, is then passed through a portion of the wire rope held between the clamping heads, thus heating it to such a degree that it becomes malleable. In the initial heating stage, the rope is twisted to bring all the strands into close contact with one another and to ensure uniform heating throughout. Tension is then applied and the rope is stretched until a pronounced waisted effect is obtained. The effect of the subsequent burning through is to allow the molten metal to weld the ends of the strands and wires securely together, forming a neat seal which prevents strands unlaying.

Our illustration shows the general appearance of the machine, which measures 2ft 9in by 4ft 8in by 4ft 2in high, and is mounted on four wheels to enable to to be readily moved to any site where a mains supply is available.

The clamping heads are of cast copper alloy, they are of ample dimensions to ensure mechanical strength, and take the form of slotted three-jaw chucks. This slotted clamping device enables the rope to be laid in the machine, so avoiding a long reeling-through operation. Two of the jaws on each head can be pre-set to accommodate the particular size of rope to be parted, and are fitted with indicating scales. The third jaw is clamped hard on to the rope by means of a special box spanner provided.

The bearing surfaces are machined and are of generous proportions in order to reduce electrical resistance to a minimum. The chuck jaws are of hard, high-conductivity copper alloy to give the maximum wear compatible with good electrical conductivity. They are renewable and easily accessible.

The torsion head, on the right of our illustration, can be rotated about its axis by means of a handwheel so that the rope can be given the desired twist. The tension head is arranged to travel in a longitudinal direction by means of a handwheel and screwed spindle on the left of the machine. This spindle is slotted along its length and forms part of a trough which leads to the centre of the clamping heads, in which the rope is laid. To avoid damage to the rope during handling the outer ends of the trough are bell-mouthed.

The gap between the heads varies from $1\frac{1}{4}$in to a maximum of $7\frac{1}{2}$in, as indicated on the scale on the left of the machine, the maximum working range being from $1\frac{1}{4}$in to $5\frac{1}{4}$in. The initial setting is determined by the size of rope and length of taper required.

Guards are fitted to prevent the ingress of flash or oil to the transformer compartment, and the side and end plates are easily removable for inspection purposes. A removable tray is laid under the clamping heads to catch any oil, &c., which may be expressed from the cores during the parting operation.

The electrical equipment consists basically of a transformer of 25kVA rating, and a contactor actuated from a pedal-operated control switch. This equipment is accommodated in a rigid cast iron and steel body below the clamping heads. An isolating switch is mounted on the left-hand side of the body, within easy reach of the operator, and provision is made for connecting to the supply mains by means of a three-pin plug and socket.

High permeability iron stampings are used for the magnetic circuit of the transformer, while the primary winding, which is tapped to give a range of eight secondary voltages, is of high-conductivity drawn copper strip, cotton insulated, impregnated and baked. The primary tappings are led to a plug box having six sockets and mounted on the right-hand side of the body, the sockets being marked "Fast," "Slow," "1," "2," "3" and "4." Two plugs are provided, one of which is for insertion in the "Fast" or "Slow" socket, and the other in one of the numbered sockets. When the plugs are inserted in "Fast" and "1," the highest secondary voltage is obtained, whilst the lowest secondary voltage is obtained when the plugs are in "Slow" and "4."

Micanite insulation is provided between the primary coil and the iron core. The ends of the secondary, which is of laminated copper strip, are attached to the clamping heads, the torsion head being insulated from the body and tension head.

The length of time for which the current is switched on depends upon the size of the wire rope to be parted, and varies from about forty-five seconds for a $\frac{3}{8}$in diameter rope to two minutes for a 1in diameter rope. These times compare with between twelve and twenty minutes required for the parting process at present in general use.

A Four-Sided Press Guard

EARLIER this year we described a novel photo-electric press guard introduced by Radiovisor Parent, Ltd., of 1, Stanhope Street, London, N.W.1. Briefly, the system consists of projecting a "curtain" of light to form a barrier across the opening of the press. The light falls on a "receiver" at the side of the machine and is concentrated on a number of photo-electric cells, the receiver being connected to a control unit incorporating relays which remain energised as long as the light rays are uninterrupted. Should, however, the operator interrupt the barrier by moving his hand or any part of his body towards the danger area, the relays are de-energised, immediately stopping the press and making further operation impossible even if the machine controls are depressed.

Such a system, of course, protects only the front of the press, which, in most instances, is quite adequate as the ends can usually be enclosed with ordinary fixed guards without any loss of efficiency. Certain types of machines, however, are open on two or more sides, as in the case of hydraulic presses, which generally require protection on all four sides. This problem arose recently when it was required to guard an hydraulic press measuring 10ft 8in long by 4ft 3in deep, and an ingenious scheme was adopted to avoid the necessity for employing four separate units, i.e., one for each side.

The front of the machine is guarded by a unit situated at the right-hand corner which projects a 16in deep by 2in wide barrier of light across the front opening, the depth of the barrier being sufficient so provide an ample margin of safety when the press is opened to its maximum position. The light falls on to a $16\frac{1}{2}$in by $4\frac{1}{2}$in mirror pedestal mounted in a pressed steel housing situated at the front left-hand corner of the press, the housing being adjustable to permit alignment with the rays. The mirror is fixed at 45 deg. to the direction of the beam, and, consequently, the light is reflected along the side of the press, falling on to a receiver mounted at the rear left-hand corner.

A second unit projects a light barrier along the opposite side of the machine on to another mirror set at 45 deg., thus reflecting the beam across the rear to a second receiver. By this means all four sides are fully protected by two units. Interruption of any beam causes the press mechanism instantly to stop, thus rendering the machine foolproof and safe even if any of the operators are hidden from the man at the controls.

Anchorage Devices for Prestressed Concrete

ONE of the main problems presented by the introduction of prestressed concrete construction is that of the anchorage and stressing arrangements for the steel. Whether the method used be that of pre-tensioning or post-tensioning, considerable controversy has arisen concerning the best anchorage techniques. The Field Test Unit of the D.S.I.R. has carried out extensive tests on numerous methods of anchorage, and some of the results of this work have now been published in a brochure entitled "Plant for Prestressed Concrete" (National Building Studies Bulletin, No. 12, H.M. Stationery Office, price 1s. 3d.).

This brochure illustrates a number of anchorage devices and is intended mainly for manufacturers of precast prestressed products. However, it includes examples of both post-tensioning and pre-tensioning methods. In the course of the work many problems connected with the operation of straining the wires, casting, vibrating and compacting the concrete and curing the cast products were encountered. Some of these problems could only be solved by inventing new devices, and it is considered that many of these devices are important contributions to the new industry.

Illustrations and descriptions are given of an experimental straining bed for pre-tensioning and of eight types of wire-gripping devices. These are of two main sorts, static and quick releasing. They can be classified as wedge, cam or clamp type. The characteristics of each type, and the functions, are indicated. Included also are methods and equipment for wire tensioning, and apparatus for stress determination and for vibrating and compacting. Difficulties experienced in stress determination and in vibration are discussed.

LONDON'S NEW TELEPHONE EXCHANGES.—The General Post Office is planning four new telephone exchanges in the City area of London to be built in the next seven years. Two of these, which will serve the London Wall exchange and Avenue exchange areas, will be housed in a building to be erected on a site in Houndsditch. Sites for the other two exchanges, which are designed to give relief to the areas served by Monarch, Metropolitan and Central exchanges, have not yet been fixed.

FILM ON POLISHING AND BUFFING METHODS.—An interesting documentary film on production polishing on the American-built Acme rotary automatics, semi-automatics and straight-line polishing and buffing machines was shown in London on Wednesday, September 27th, by Dowding and Doll, Ltd., who are the distributors of Acme equipment in this country. The film was made in modern plants in the United States, where Acme machines are handling many jobs previously thought to be unsuitable for automatic polishing.

Industrial and Labour Notes

The Industrial Situation

A regional meeting of the Federation of British Industries was held at Huddersfield on Wednesday of last week and was addressed by Sir Robert Sinclair, President of the F.B.I. In the course of his speech, Sir Robert said that the attitude of the Federation towards nationalisation and State control was unchanged. Nothing had happened in the working of nationalised industry to shake the conviction that such measures did not lead to efficiency and that nationalised industries laboured under very grave handicaps because control must be, in the nature of things, so remote, and responsibility so vague. On the timing of the taking over of the steel industry, Sir Robert commented that in these grave and difficult days the inevitable disturbance arising from such a change should not be precipitated. The arrangements for vesting and all that was involved in the setting up of the Steel Corporation and its subsidiary organisations must mean a heavy drain upon the time and thought of many whose energies and ability were so important to the defence programme. It could only be hoped, Sir Robert added, that considerations of national unity and national safety might yet take precedence over political considerations, and that some agreed basis for postponement might be found.

Later in his address, Sir Robert referred to the demands of the defence programme, saying that he had the greatest belief in the flexibility and the capacity for improvisation in British industry. But, he went on, because under certain conditions productivity was showing a satisfactory increase, we ought not to be too ready to assume that that could take in its stride the effect of the inevitable temporary dislocation involved in the change-over from civil to military production. A considerable switch of manpower was clearly indicated, and there were bound to be shortages of certain types of key workers. One other factor mentioned by Sir Robert was the possible temporary shortage of raw materials and certain components. It was only human nature, he said, that in the circumstances of to-day most people should be anxious to avoid being caught short in the matter of essential supplies. But, Sir Robert warned, unrestricted stockpiling, under present conditions, to a point of over-insurance would simply precipitate the need for rationing or controls. He believed that individual firms which felt that there were possible dangers of shortages in their materials or components would do well, before placing orders, to discuss the position in their own industries and with their own suppliers, with a view to seeing how best the position could be safeguarded without precipitating a general scramble and artificially increased shortages.

Average Earnings and Working Hours

Twice a year, the Ministry of Labour makes an inquiry to obtain particulars of the average weekly earnings and working hours of manual wage-earners employed in manufacturing industries generally, and in a number of the non-manufacturing industries, of the United Kingdom. The most recent of these inquiries related to the last pay week in April, and the Ministry has now summarised the figures which it obtained.

About 57,500 establishments supplied information, and the total number of wage-earners covered by the investigation was nearly 6,500,000. In the manufacturing and non-manufacturing industries classified according to the Ministry's standard practice, the average earnings in the last pay week of April were found to be as follows :—Men of twenty-one and over, £7 5s. 9d.; youths and boys, £3 1s. 5d.; women of eighteen and over, £4 0s. 6d.; girls, £2 11s. 10d. It is of special interest to note that in the industries grouped as "engineering, shipbuilding and electrical goods" the average earnings during the last week of April were :—Men, £7 10s. 11d.; youths and boys, £2 15s. 2d.; women, £4 2s. 10d.; girls, £2 11s. 9d. Taking all the industries included in the survey, the Ministry's report shows the following percentage increases in average weekly earnings between October, 1938, and April, 1950 :—Men, 111 per cent; youths and boys, 136 per cent; women, 148 per cent; and girls, 180 per cent. It is pointed out, of course, that these percentage increases in average earnings represent the combined effect of a number of factors, including increases in wage rates, changes in the number of hours worked and in the proportion of hours paid for at overtime rates, extension of systems of payment by results in some industries and increased output by the workers affected, changes in the proportions of men, boys, women and girls employed in different occupations, and changes in the proportions of workers employed in different industries. It should be added that among the employments excluded from the survey are agriculture, coal mining, railway service, shipping service and port transport.

The average hours worked in the last pay week of April in all the industries—manufacturing and non-manufacturing—surveyed were : men, 47 hours; youths and boys, 44·2 hours; women, 41·9 hours; and girls, 42·5 hours. Taking the "engineering, shipbuilding and electrical goods" group, the figures of average hours were 47, 43·6, 42·3 and 42·2 respectively. As a comparison the survey records that in October, 1938, the average weekly hours worked in all industries were :—Men, 47·7 hours; youths and boys, 46·2 hours; women, 43·5 hours; and girls, 44·6 hours.

Trade Disputes

According to *The Ministry of Labour Gazette*, there were ninety-nine stoppages of work through industrial disputes in progress during the month of August. Altogether, they affected 18,000 workers and caused an aggregate loss of 52,000 working days in that month. In July, ninety-one stoppages of work occurred, involving 44,200 workers and resulting in an aggregate loss of 250,000 working days. The majority of the stoppages in August were in the coal mining industry, which lost 14,000 working days as a result.

In its report, the Ministry of Labour notes the causes of the ninety disputes leading to stoppages of work, which actually began in the month of August. It says that four of the disputes arose out of demands for wage increases, and forty were concerned with other wage questions; seven stoppages were over questions relating to the employment of particular classes or persons, and thirty-four over other matters concerned with working arrangements; four stoppages were claimed to be over questions of trade union principle, and one stoppage was in support of workers involved in another dispute.

In the first eight months of this year stoppages of work in the United Kingdom, through industrial disputes, numbered 929, involved 206,500 workpeople, and caused an aggregate loss of 890,000 working days. In the corresponding period of 1949 there were 996 stoppages, in which 360,200 workers were concerned, and on account of which 1,463,000 working days were lost.

Production and Wages

The annual general meeting of the General Electric Company, Ltd., was held in London on Thursday of last week, and was addressed by the chairman, Sir Harry Railing. In the course of his speech, Sir Harry referred to wages and spending power, pointing out that no individual could, for long, spend more than he earned, no company could spend more in wages than was earned by those wages, and no Government could give more to the people than they themselves produced. Standards of living, individually or co-operatively, Sir Harry declared, depended entirely on the national production and the assets created by it.

In the first place, to-day, Sir Harry continued, there must be more output from all existing facilities, greater output per man year, more output per machine year and per square yard of factory and office, both from Government and industry. That, he suggested, meant longer working hours, especially where there were bottlenecks in production, and it meant inducements to those men who worked harder than others and therefore contributed more to the common fund. Sir Harry then went on to plead for less waste caused by unrealistic wage demands and unnecessary friction, for, he said, we could not afford it. General wage increases did not automatically give an increase in production, and without that they could only be taken from the funds available for other purposes, such as social services and essential capital requirements. They were, therefore, bound to be harmful instead of beneficial to the community as a whole, Sir Harry asserted, and also to the recipients, until additional margins—and that meant profit margins—became available from an increased production.

The Trades Union Congress

The General Council of the Trades Union Congress met in London last week. It was the Council's first meeting since the annual assembly of the Congress early in September, when, it may be recalled, a resolution was passed demanding the dropping of any policy of wage restraint.

One matter to which the General Council gave some attention last week was the question of joint consultation in industry to facilitate the solution of problems arising from the increased armament programme. It is reported that the Government has made suggestions for the establishment of some new consultative machinery representing Government departments, employers and the trade unions. At present, of course, matters relating to industrial production are surveyed periodically by the National Production Advisory Committee for Industry, which meets under the chairmanship of the Chancellor of the Exchequer. Labour and allied problems are reviewed quarterly by the Minister of Labour's National Joint Advisory Council.

Iron and Steel Statistics

The British Iron and Steel Federation has just published Part II of its Statistical Year Book for 1948. It is a volume of no less than 432 pages, containing detailed information relating to production and trade in iron and steel in about forty overseas countries. A particularly useful feature is the inclusion of pre-war data in cases where it has been possible to obtain it. Summary tables showing world production of iron ore, pig iron and steel, together with a number of useful maps, are also given. In fact, there seems little doubt that the volume is the most comprehensive statistical guide to the iron and steel industries of the world at present available. Its price is fifteen shillings and copies can be obtained from the Federation at Steel House, Tothill Street, London, S.W.1.

Coal Output

A report by the Ministry of Fuel and Power shows that the saleable output of coal in Great Britain, in the week ended September 23rd, totalled 4,296,900 tons, of which 4,053,300 tons were raised from the deep mines. This figure again indicates recovery from the effects of the holiday season, the estimated amount lost through recognised holidays being given as 20,200 tons, compared with 45,500 tons in the preceding week. In the first thirty-eight completed weeks of this year coal production totalled 156,326,000 tons, as against 154,505,600 tons in the corresponding period of last year.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of their insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

British Institution of Radio Engineers

Wed., Oct. 11th.—N.E. SECTION: Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle-on-Tyne, "High-Fidelity Reproduction," H. J. Leak, 6 p.m.

Engineer Surveyors' Association

To-day, Oct. 6th.—Lighting Services Bureau, 2, Savoy Hill, London, W.C.2, "Fluorescent Lamps," C. R. Bicknell, 6.30 p.m.

Engineers' Guild

To-day, Oct. 6th.—YORKSHIRE BRANCH: Great Northern Hotel, Leeds, annual general meeting, 7 p.m.

Illuminating Engineering Society

To-day, Oct. 6th.—BATH AND BRISTOL CENTRE: Provident Hall, Prewett Street, Bristol, "Light, Colour and the Stage," E. E. Faraday, 7 p.m.——BIRMINGHAM CENTRE: Imperial Hotel, Temple Street, Birmingham, Chairman's Address, F. Penson, 6 p.m.——LEEDS CENTRE: Guildford Hotel, The Headrow, Leeds, 1, Chairman's Address, J. W. Howell, 7 p.m.——HUDDERSFIELD GROUP: Electricity Showrooms, Market Street, Huddersfield, "Fluorescent Lighting in the Hospital," J. K. Frisby, 7.15 p.m.

Tues., Oct. 10th.—Royal Society of Arts, John Adam Street, Adelphi, W.C.2, Presidential Address, L. J. Davies, 6 p.m.——LIVERPOOL CENTRE: The Temple, 24, Dale Street, Liverpool, Chairman's Address, T. D. Woods, 6 p.m.——STOKE-ON-TRENT GROUP: 31, Kingsway, Stoke-on-Trent, "Floodlighting," M. W. Peirce, 6 p.m.

Wed., Oct. 11th.—EDINBURGH CENTRE: Lighting and Cleansing Department, High Street, Edinburgh, "Coloured and Directional Light as Applied to the Stage," L. G. Applebee, 7 p.m.

Thurs., Oct. 12th.—GLASGOW CENTRE: Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, "Coloured and Directional Light as Applied to the Stage," L. G. Applebee, 6 p.m.——LEICESTER CENTRE: E. Midlands Electricity Board, Charles Street, Leicester, Presidential Address, L. J Davies, 6.30 p.m.——MANCHESTER CENTRE: Town Hall Extension, Manchester, "Recent Advances in Ophthalmology," D. L. Charters, 6 p.m.

Incorporated Plant Engineers

Mon., Oct. 9th.—KENT BRANCH: Old Palace, Maidstone, "The Use of Compressed Air in Industry," 7 p.m.——DUNDEE BRANCH: Mathers Hotel, Dundee, "Industrial Heating and Choosing the System," H. W. L. Tuckey, 7.30 p.m.

Wed., Oct. 11th.—E. MIDLANDS BRANCH: Welbeck Hotel, Nottingham, "Instruments in General Use in Engineering," E. W. R. Little, 7 p.m.

Thurs., Oct. 12th.—NEWCASTLE-ON-TYNE BRANCH: Royal Turks Head Hotel, Newcastle-on-Tyne. "Mineral Wool—Manufacture and Application," A. M. McGregor, 7.30 p.m.

Institute of British Foundrymen

Sat., Oct. 7th.—W. RIDING OF YORKS BRANCH: Tech. Coll., Bradford, discussion initiated by G. W. Nicholls on the Iron Founders' Productivity Team Report, 6.30 p.m.——WALES AND MONMOUTH BRANCH: Engineers' Institute, Cardiff, "The Production of Castings for Internal Combustion Engines," C. R. van der Ben and H. Haynes, 6 p.m.

Mon., Oct. 9th.—SCOTTISH BRANCH: Tech. Coll., George Street, Glasgow, Presidential Address, James G. Arnott, 3 p.m.

Wed., Oct. 11th.—BIRMINGHAM AND WEST MIDLANDS STUDENTS' SECTION: Tech. Coll., Dudley, "Foundry Mechanisation," J. Hunter, 7.15 p.m.

Institute of Industrial Supervisors

Tues., Oct. 10th.—DUDLEY AND DISTRICT SECTION: Tech. Coll., Dudley, "Good Housekeeping," R. Bramley-Harker, 7.30 p.m.

Thurs., Oct. 12th.—WEDNESBURY AND DARLASTON SECTION: Works Canteen, Joseph Sankey and Sons, Ltd., Bilston, "Factory Organisation and Administration," S. Waugh, 7.30 p.m.——CARDIFF SECTION: Conference Room, Hoover (Washing Machines), Ltd., Merthyr Tydfil, "Production Planning and Shop Loading," J. Ball, 7 p.m.——LONDON CENTRAL SECTION: The Polytechnic, Regent Street, W.1, "Education, Training and Production," T. B. Worth, 7.30 p.m.

Institute of Marine Engineers

Mon., Oct. 16th.—85, Minories, E.C.3, "The High-Speed Lightweight Diesel Engine," J. H. D. Middleton, 5.30 p.m.

Institute of Metals

Tues., Oct. 10th.—S. WALES LOCAL SECTION: University College, Singleton Park, Swansea, "The Revival of the Non-Ferrous Metal Industry in South Wales," E. A. Hontoir, 6.30 p.m.

Institute of Petroleum

Wed., Oct. 11th.—26, Portland Place, London, W.1, "The Role of Petroleum in European Recovery," Vernon Smith, 5.30 p.m.

Institute of Road Transport Engineers

Mon., Oct. 9th.—MIDLANDS CENTRE: Mechanics' Institute, Nottingham, open meeting, 7.30 p.m.

Wed., Oct. 11th.—N.W. CENTRE: Adelphi Hotel, Liverpool, "Recent Developments in Rear Axles," T. R. Beady, 7 p.m.

Fri., Oct. 13th.—S. WALES GROUP: British Oxygen Company, Caerphilly Road, Cardiff, "Specialised Welding as Applied to Road Transport Engineering," 6.30 p.m.

Institution of Chemical Engineers

Tues., Oct. 10th.—Institution of Civil Engineers, Great George Street, Westminster, S.W.1, discussion on the Provisional British Standard Code 1500: 1949, for Fusion-Welded Pressure Vessels for Use in the Chemical and Allied Industries, 5.30 p.m.

Institution of Electrical Engineers

Mon., Oct. 9th.—S. MIDLAND CENTRE: Grand Hotel, Birmingham, Chairman's Address, D. H. Kendon, 6 p.m.——LONDON STUDENTS' SECTION: Savoy Place, Victoria Embankment, W.C.2, Chairman's Address, I. J. Shelley, "Television—An Introduction to the Generation and Transmission of Television Signals," 7 p.m.——N.E. CENTRE: Neville Hall, Westgate Road, Newcastle-on-Tyne, Chairman's Address, P. J. Ryle, 6.15 p.m.

Tues., Oct. 10th.—MEASUREMENTS SECTION: Savoy Place, Victoria Embankment, W.C.2, Chairman's Address, G. A. V. Sowter, 5.30 p.m.

Institution of Engineering Inspection

Tues., Oct. 10th.—WOLVERHAMPTON BRANCH: Compton Grange, Wolverhampton, "Dynamic Balancing Machines," A. Binns, 7.15 p.m.

Institution of Heating and Ventilating Engineers

Wed., Oct. 11th.—Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1, autumn general meeting, "Design and Manufacture of Steel Tubes," J. S. Blair, 6 p.m.

Institution of Mechanical Engineers

To-day, Oct. 6th.—N.E. BRANCH, GRADUATES' SECTION: Northern Gas Board Showrooms, Grainger Street, Newcastle-upon-Tyne, "The Bulk Distribution and Handling of Petroleum Products," P. L. Barnes, 7 p.m.

Tues., Oct. 10th.—AUTOMOBILE DIVISION: Storey's Gate, St. James's Park, S.W.1, annual general meeting, 5.30 p.m.

Institution of Production Engineers

To-day, Oct. 6th.—W. WALES SUB-SECTION: Central Library, Alexandra Road, Swansea, "British Clocks and Watch Production," Robert Lenoir, 7.30 p.m.

Sat., Oct. 7th.—N.E. GRADUATE SECTION: Works visit to Consett Iron Company, Consett, 10 a.m.

Mon., Oct. 9th.—HALIFAX SECTION: Whiteley's Cafe, Westgate, Huddersfield, "Costing as an Aid to Management," H. H. Norcross, 7.15 p.m.——YORKSHIRE SECTION: Hotel Metropole, Leeds, "Colour Schemes in Industry," S. A. Wood, 7 p.m.——LIVERPOOL GRADUATE SECTION: Exchange Hotel, Liverpool, "Graduate Status—Its Responsibility and Implications," T. B. Worth, 7.45 p.m.——SHEFFIELD SECTION: Royal Victoria Station Hotel, Sheffield, address by Major-General K. C. Appleyard, 6.30 p.m.

Tues., Oct. 10th.—DUNDEE SECTION: Mathers Hotel, Whitehall Crescent, Dundee, "The Measurement of Productivity," Walter C. Puckey, 7.30 p.m.——BIRMINGHAM GRADUATE SECTION: James Watt Memorial Institute, Great Charles Street, Birmingham, "Modern Methods and Developments in Heat-Treatment Practice," K. J. B. Wolfe, 7 p.m.——MANCHESTER GRADUATE SECTION: College of Technology, Sackville Street, Manchester, "Foundry Control," H. A. Fox, 7.15 p.m.

Wed., Oct. 11th.—LIVERPOOL SECTION: Exchange Hotel, Tithebarn Street, Liverpool, Brains Trust, 7.15 p.m.——WESTERN SECTION: Grand Hotel, Broad Street, Bristol, "British Management at the Cross Roads," Lewis C. Ord, 7.15 p.m.

Thurs., Oct. 12th.—SOUTHERN SECTION: Polygon Hotel, Southampton, "Efficient Tooling for Production," B. Holloway, 7 p.m.——LONDON SECTION: Royal Empire Society, Northumberland Avenue, W.C.2, "The Future of Production Engineering," C. R. Whitaker, 7 p.m.

Fri., Oct. 13th.—N.E. GRADUATE SECTION: Neville Hall, Westgate Road, Newcastle-on-Tyne, address by the Section President, R. W. Mann, 7 p.m.

Institution of the Rubber Industry

Mon., Oct. 9th.—James Watt Memorial Institute, Great Charles Street, Birmingham, "Mixing Machinery," W. H. Reece, 6.45 p.m.

Institution of Structural Engineers

Wed., Oct. 11th.—YORKSHIRE BRANCH: Great Northern Hotel, Leeds, Chairman's Address, H. C. Husband, 6.30 p.m.

Thurs., Oct. 12th.—11, Upper Belgrave Street, London, S.W.1, Presidential Address, J. E. Swindlehurst, 6 p.m.

Fri., Oct. 13th.—WESTERN COUNTIES BRANCH: Grand Hotel, Bristol, Chairman's Address, P. C. Girdlestone, 6.15 p.m.

Institution of Works Managers

To-day, Oct. 6th.—NOTTS AND DERBY BRANCH: Mechanics' Institute, Burton Street, Nottingham, "Industrial Management and its Human and Social Implications," A. P. Young, 7.30 p.m.

Tues., Oct. 10th.—MERSEYSIDE BRANCH: Adelphi Hotel, Liverpool, "The Factories Act, 1948," C. P. Gourley, 6.30 p.m.——PRESTON GROUP: Starkie House, Starkie Street, Preston, "Problems of British Industry To-day," L. C. Ord, 7 p.m.——W. MIDLAND BRANCH: Grand Hotel, Birmingham, "Glass Manufacture," R. E. Bastick, 7 p.m.

Thurs., Oct. 12th.—WEMBLEY SUB-BRANCH: "The Plough," Kenton Road, Kenton, "Some Aspects of Works and Sales Co-operation," J. G. Christopher, 12.30 p.m.——TEES-SIDE BRANCH: Vane Arms Hotel, Stockton, "Managing a Small Factory," D. G. Petrie, 7.30 p.m.

Fri., Oct. 13th.—Grand Hotel, Manchester, "The Development of Industry in the Greater Manchester Area," T. H. G. Stevens, 6.30 p.m.

Junior Institution of Engineers

To-day, Oct. 6th.—39, Victoria Street, S.W.1, Film Evening, "The Manipulation of Corrosion and Heat-Resisting Steels," "Some Applications of Firth Vickers Special Steels," 6.30 p.m.

Fri., Oct. 13th.—39, Victoria Street, S.W.1, Chairman's Address, "Prestressed and Vibrated Concrete," S. J Crispin, 6.30 p.m.

Manchester Association of Engineers

To-day, Oct. 6th.—Engineers' Club, Albert Square, Manchester, Inaugural Address by the President, J. Adamson, 6.45 p.m.

Newcomen Society

Wed., Oct. 11th.—Victoria and Albert Museum, S.W.7, Reunion of members, ordinary general meeting, Presidential Address, C. H. Desch, 4.30 p.m.

Old Centralians

Fri., Oct. 13th.—Chez Auguste, Frith Street, W.1, "The Shape of the British Navy of the Immediate Future," Sir Charles Lillicrap, 12.55 p.m.

Sheet and Strip Metal Users' Technical Association

Wed., Oct. 11th to Fri., Oct. 13th.—Charing Cross Hotel, London, W.C.2, annual autumn conference.

Stephenson Locomotive Society

Sun., Oct. 8th.—Visit to Swindon and shed, Western Region, B.R., 1.45 p.m.

Personal and Business

MR. J. REID YOUNG has been appointed a director of S. Smith and Sons (England), Ltd.

MR. W. E. W. PETTER has been appointed deputy managing director of Folland Aircraft, Ltd.

MR. W. S. STEEL, M.I.E.E., has been elected a director of The British Thomson-Houston Co. Ltd.

MR. G. W. HARRIMAN has been appointed deputy managing director of the Austin Motor Company, Ltd.

MR. A. H. BANKS has retired from the post of chief labour relations officer, British Electricity Authority.

MR. T. W. POLLOCK has been appointed managing director of Penman and Co., Ltd., Caledonian Ironworks, 64, Strathclyde Street, Glasgow.

MR. K. C. BANKS and Mr. J. N. Compton M.I.Mech.E., have been appointed directors of Yorkshire Engine Company Ltd., Sheffield.

CAPTAIN (E) G. VILLAR, R.N. ret., Mr. K. C. Barnaby and Mr. L. L. Holt, have been appointed directors of John I. Thornycroft and Co., Ltd.

MR. H. COPPING, M.I.E.E., has been appointed, general sales manager in the electrical equipment division of Newman Industries Ltd., Yate, Bristol.

MR. W. A. ANKERSON, B.Sc. (Eng.), A.M.I.E.E., has been appointed manager of the dominions division of Metropolitan-Vickers Electrical Export Company, Ltd.

MR. H. B. ROBIN ROWELL has been elected Chairman, and Mr. J. Ramsay Gebbie, Vice-Chairman of the Council of the British Shipbuilding Research Association.

THE CANADIAN PACIFIC RAILWAY COMPANY announces the retirement of Mr. R. B. Jones, assistant chief engineer. Mr. R. A. Emerson has been appointed to succeed him.

MR. H. B. DAUNCEY has been elected a director of T. H. and J. Daniels Ltd., Stroud. He has been in the company's service since 1907 and has been works manager for the past thirty years.

THE MINISTER OF TRANSPORT has approved the appointment of Mr. Miles Beevor, nominated by the British Transport Commission, to the Central Transport Consultative Committee, in place of Mr. M. A. Cameron who has resigned.

ELECTRO-HYDRAULICS, Ltd., Warrington, states that its range of "Conveyancer" fork trucks will be marketed in future by a subsidiary registered as the Conveyancer Fork Truck Company, the address of which is Liverpool Road, Sankey, Warrington.

ALBRIGHT AND WILSON, Ltd., 49, Park Lane, London, W.1, and the Dow Corning Corporation of America announce the formation of a new company, Midland Silicones, Ltd., which is now responsible for all the activities hitherto undertaken by the silicone department of Albright and Wilson, Ltd.

THE SOUTH-WESTERN ELECTRICITY BOARD announces the following appointments:—Mr. L. S. Gould, A.M.I.E.E., distribution engineer, chief engineer's department, Bristol headquarters; Mr. A. C. E. Bunker, administrative officer, Cornwall sub-area; Mr. A. E. Mulvaney, district commercial officer, Torbay.

PARANOX 56 G.B.—The Anglo-American Oil Company, Ltd., announce that a plant recently completed at Fawley is producing the heavy-duty barium and sulphur-containing additive for lubricating oils, Paranox 56.